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Tasmanian Trechinae and Psydrinae (Coleoptera, Carabidae): a taxonomic and biogeographic synthesis, with description of new species and evaluation of the impact of Quaternary climate changes on evolution of the subterranean fauna[(3)]

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ABSTRACT
This paper provides taxonomic, distributional and ecological data for 59 species in 17 genera of Trechinae and Psydrinae from Tasmania, and describes 18 new species in six existing genera (*Pterocyrtus, Tasmanorites, Sloanella, Trechistus, Goedetrechus, Tasmanotrechus*) collected from caves, forest and montane habitats: *Pterocyrtus grayi* sp. nov., *P. meridionalis* sp. nov., *Tasmanorites beatricis* sp. nov., *T. daccordii* sp. nov., *T. lynceorum* sp. nov., *T. microphthalmus* sp. nov., *Sloanella gordoni* sp. nov., *Trechistus gordoni* sp. nov., *Goedetrechus minutus* sp. nov., *G. rolani* sp. nov., *G. florentinus* sp. nov., *G. damperi* sp. nov., *Tasmanotrechus gordoni* sp. nov., *T. alticola* sp. nov., *T. montisfieldi* sp. nov., *T. osbornianus* sp. nov., *T. moorei* sp. nov., *T. rolani* sp. nov. Forty-one (41) previously described species have been re-examined and illustrated with supplementary descriptions. New collection records combined with the published literature revealed 196 records of 83 species in 21 genera, collected from 41 localities (including 11 karst areas). Regional-scale survey coverage has been patchy and three biogeographic regions stand out as poorly surveyed: Flinders, South East, and Northern Midlands. Local-scale survey efforts have been intensive at just a few localities, the richest being 18 species recorded at Cradle Mountain. Seventeen (17) described species of Zolini and Trechini are troglobites with distribution ranges restricted to individual karst areas. Some karst areas and caves harbour multiple congeneric species which differ in their degree of troglomorphic specialization suggesting heterochronic colonisations, possibly linked to multiple Quaternary glacial / inter-glacial cycles. Palaeo-climatic and palaeo-vegetation evidence is examined to test the 'Climatic Relict Hypothesis' as a mechanism driving evolution of the subterranean fauna. It is proposed that present-day troglobitic Trechinae in Tasmania are derived from troglophilic progenitors that colonised subterranean habitats from adjacent forest ground litter habitats during Pleistocene inter-glacial periods, while retreat of forests during glacial periods isolated subterranean populations from surface populations facilitating troglogenesis. It is predicted that future collecting efforts will reveal many additional new subteranean species, including in non-karstic Shallow Subterranean Habitats (SSH).

Key words: Tasmania, Trechinae, Psydrinae, cave, beetles

INTRODUCTION

Tasmania is well known to be remarkably rich in endemic ground beetles, especially the Trechinae (Donabauer 2001). After the monographic work by Sloane (1920) on Carabidae of Tasmania, Jeannel (1927) was the first to deal in an organic way with the systematics of the Trechini of Tasmania. After these fundamental contributions, fifty years elapsed before two contributions by Moore (1963, 1972) addressed in a systematic manner the Carabidae, Trechodina, Trechina and Psydrini of this island. Later, a tentative key to the genera of Australian and Tasmanian Trechini known at the time was given by Casale & Laneyrie (1982). Subsequently, Moore, in a series of specific works (1978, 1983, 1984 and 1994), described several cave dwelling genera and species. Donabauer (2001) described a new species of *Tasmanorites* and provided drawings of the male genitalia of several other species in this genus. Most recently, Baehr (2005) provided an excellent review of Australian species of Amblytelini. This contribution stems initially from specimens collected from caves in the 1980's by one of the authors (S.E.) and sent to the late Lucien Genest of Grenoble (France). Lucien Genest, before his passing, sent these materials to the second author (P.M.G.) thereby stimulating his interest in the carabid beetle fauna of Tasmania. This original collection has been added to with material obtained from other en-

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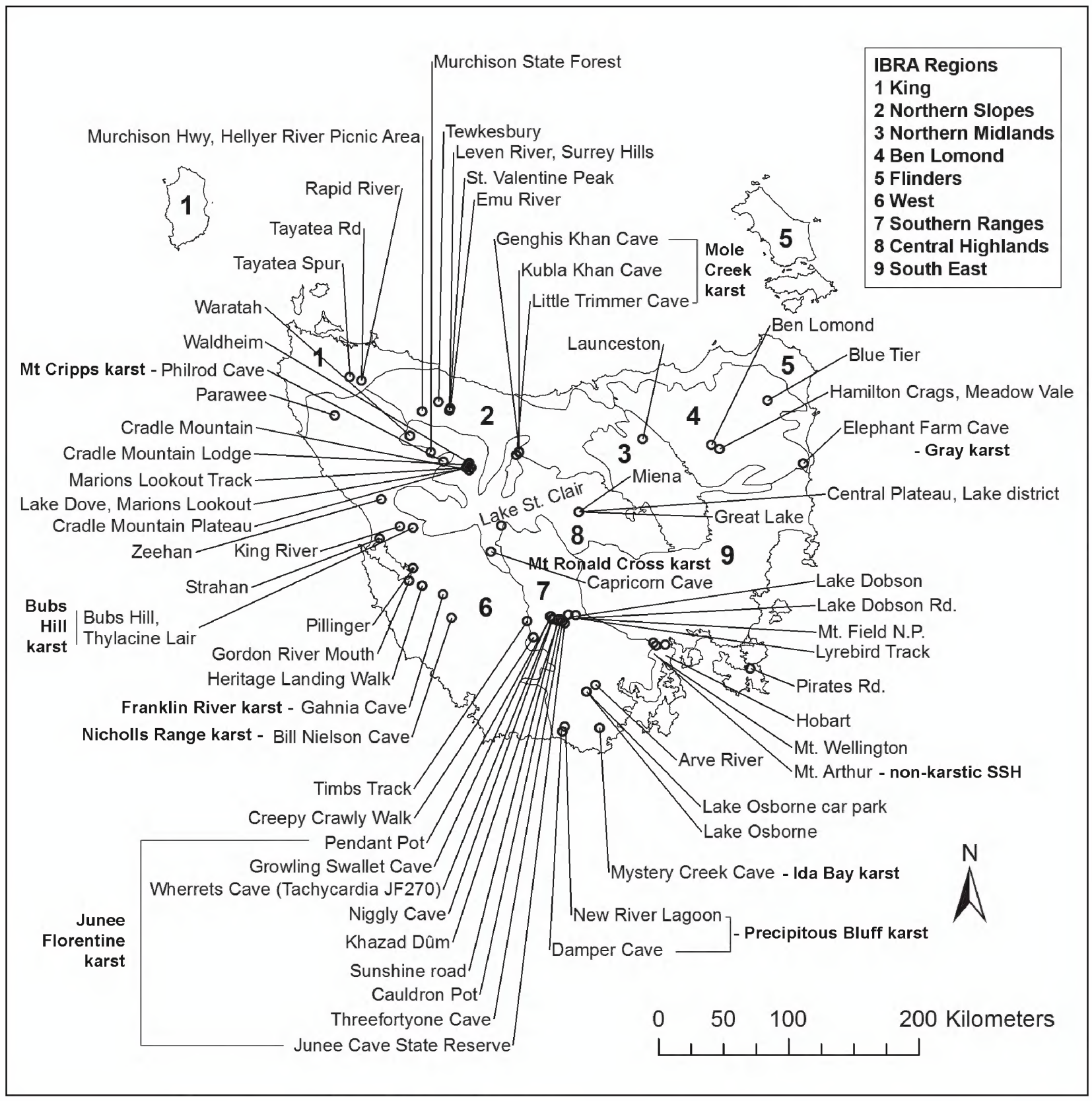
tomologists and further collections made by P.M.G in 1998, 1999 and 2002 during research expeditions sponsored by the Accademia Nazionale dei Lincei in Rome (Map 1). These expeditions focused on finding species already identified as new to science but known only from single individuals (Giachino 2005). Attempts to collect additional specimens of some species were not always successful, however, they resulted in the finding of additional new species described herein. Besides our field collections, forty-one (41) previously described species were re-examined as part of this study, and given the scarcity of illustrations in the literature (Jeannel 1927; Donabauer 2001; Moore 1963, 1972, 1978, 1983, 1984, 1994) we saw the need to provide drawings of male genitalia and the habitus (often of the type material), in addition to a brief description where possible. We have also mapped the collection sites for all species mentioned in this paper, which will help to consolidate the systematics and biogeography of Tasmanian Carabidae and assist in future identification, description and focusing of survey and conservation efforts.

MATERIAL AND METHODS

The examined materials are preserved in the following collections:

BMNH The Natural History Museum, London, England
QVML Queen Victoria Museum, Launceston, Tasmania, Australia
MVM Museum of Victoria, Melbourne, Victoria, Australia



Map 1 - Localities for carabid material collected during this study shown in relation to Tasmania's Biogeographic Regions (IBRA version 6.1 Commonwealth of Australia 2004).

MCSNG Museo Civico di Storia Naturale "G. Doria", Genova, Italia
MRSN Museo Regionale di Scienze Naturali, Torino, Italia
SAM South Australian Museum, Adelaide, South Austrealia
TMH Tasmanian Museum and Art Gallery, Hobart, Tasmania, Australia
CGi Giachino Collection, Torino, Italia

The following acronyms for type material have been used:

HT Holotype
PT, PTT Paratype(s)
CT Cotype
LT Lectotype
PLT, PLTT Paralectotype(s)

The drawings of the habitus were made using a camera lucida attached to a Leica MZ 12.5 microscope. The drawings of male genitalia, after inclusion in Canada balsam, were made using a camera lucida attached to a Leica DM 2500 microscope with interference contrast.

Total length of specimens was measured from apical margin of labrum to tip of elytra. The acronym PW/PL represents instead the width/length ratio of the pronotum.

Given the scarcity of iconography available in the literature (Jeannel 1927; Donabauer 2001; Moore 1963, 1972, 1978, 1983, 1984, 1994) drawings of male genitalia and the habitus of previously described species (often of the type material), in addition to a brief description, were made whenever possible.

The suprageneric systematics used is that proposed by Lorenz (2005).

TAXONOMY

Trechinae Bonelli, 1810
Zolini Sharp, 1886
Genus *Percodermus* Sloane, 1920
Type species: *Percodermus niger* Sloane, 1920
Percodermus Sloane, 1920: 140.
Percodermus Sloane: Moore et al, 1987: 123.
Percodermus Sloane: Lorenz, 2005: 201.

Percodermus niger Sloane, 1920
(Figs 1-2)

Loc. Typ.: Great Lake, Tasmania.
Percodermus niger Sloane, 1920: 140.
Percodermus niger Sloane: Moore et al, 1987: 123.
Percodermus niger Sloane: Lorenz, 2005: 201.

Type material

LT ♂, Great Lake 3/91 (white, handwritten and printed), Type (white, printed), *Percodermus niger* Sl. Id. by T.G. Sloane (white, handwritten and printed), *Percodermus niger* Sl. Tasmania Type (white with black and red handwriting), Lectoholo- *P. niger* Sl. PID (red, handwritten) (SAM).

Examined material

2 ♂♂ 1 ♀, Australia, Tas., Lake St. Clair N.P. m 740, rainforest sieved litter, 23.I.2002, P.M. Giachino leg. (CGi); 1 ♂, Australia, Tas., Cradle Mts N.P., Cradle Mts Lodge m 800, 30.I.2002, P.M. Giachino leg. (CGi).

Diagnosis and redescription

Length mm 5.67-6.06. Body elliptical-oval, subdepressed, black and shiny; legs and antennae piceous or piceous red with femora darker than tibiae and base of antennae reddish. Head short, with eyes large, round and prominent. Antennae slender, hardly exceeding the base of the pronotum when stretched backwards. Pronotum subquadrate, widest in the middle or just before the middle; sides arcuate anteriorly, straight or subsinuate to base. Base straight, widest than anterior side, with angles obtuse, blunted, not prominent. Basal setae absent, anterior marginal setae inserted in the middle. Elytra elliptical, with disc lightly striate; juxtascutellar stria present (between scutellum to 1st stria), short; apical recurrent striole short, subrectilinear, ending at the level of 6th stria. Chaetotaxis: juxtascutellar pore present; third interval 4-(or 5-) with setiferous pores. Aedeagus (Fig. 2) small (length 1.24 mm), with basal bulb small; median lobe, in lateral view, abruptedly curved at the basal 6th, rectilinear in the apical 5/6. Apex short, stumpy and slightly bent upwards in a beak shape. Inner sac medially provided with a copulatory piece shaped like a large spoon. Parameres broad and not very long, reaching the apical third, each provided with 5 apical setae.

Distribution and ecology

Sloane (1920) and Moore et al (1987) mention this species only in the zone of Great Lake (Central Tasmania) and there are not at present, as far as we know, any other data in the literature. The new sites of Lake St. Clair and Cradle Mts. increase considerably towards W and NW the known area of this species (Map 2). Even in the two new localities, as shown by Moore et al (1987), *P. niger* was found by sieving litter in a tall *Nothofagus* forest.

Genus *Sloaneana* Csiki, 1933
Type species: *Brachydema tasmaniae* Sloane, 1915.
Brachydema Sloane, 1915: 452 (nec *Brachydema* Fairmaire, 1881).
Brachydema Sloane: Sloane, 1920: 139.
Sloanella Csiki, 1928: 224 (nom. nov. for *Brachydema* Sloane, 1915; nec *Sloanella* Jeannel, 1927).
Sloaneana Csiki, 1933: 1651 (nom. nov. for *Sloanella* Csiki, 1928).
Sloaneana Csiki: Moore et al, 1987: 123.
Sloaneana Csiki: Lorenz, 2005: 201.

Sloaneana tasmaniae (Sloane, 1915)
(Figs 3-4)

Loc. Typ.: Mt. Wellington, Tasmania.
Brachydema tasmaniae Sloane, 1915: 452.
Brachydema victoriae Sloane, 1915: 452.
Brachydema tasmaniae Sloane: Sloane, 1920: 139.
Sloanella tasmaniae Sloane: Csiki, 1928: 224.
Sloaneana tasmaniae Sloane: Csiki, 1933: 1651.
Sloaneana tasmaniae (Sloane): Moore et al, 1987: 123.
Sloaneana tasmaniae (Sloane): Lorenz, 2005: 201.

Examined material

9 ♂♂ 9 ♀♀, Australia, Tas., Mt. Field N.P., Lake Dobson Rd., m 690, 16.I.2002, P.M. Giachino leg. (CGi); 3 ♂♂ 5 ♀♀, Australia, Tas., Hartz Mts. N.P., Lake Osborne car park, m 900, 20.I.2002, rainforest, P.M. Giachino leg. (CGi); 11 ♂♂ 6 ♀♀, Australia, Tas., Lake St. Clair N.P. m 740, rainforest sieved litter, 23.I.2002, P.M. Giachino leg. (CGi); 1 ♂ 1 ♀, Australia, Tas., Murchison Hwy., Hellyer Gorge St. Res., Hellyer River Picnic Area, 30.I.2002, P. M. Giachino leg. (CGi); 1 ♂ 2 ♀♀, Australia, Tas., South Arthur Forest, Tayatea Rd., Tayatea Spur 7, 29.I.2002, P. M. Giachino leg. (CGi); 2 ♂♂, Australia, Tas., Gordon River Rd., Florentine Valley, Timbs Track, m 460, 17.I.2002, P.M. Giachino leg. (CGi); 1 ♂ Australia, Tas. Hampshire, Companion Reserve, m 600, S. Valentine Peak (rainforest), 29.XI.1998, P.M. Giachino leg. (CGi); 1 ♂, Australia, Tas., Mt. Field N.P., m 750, under bark, 5.XII.1998, P.M. Giachino leg. (CGi); 1 ♂, Australia, Tas., Maydena, Southwest N.P., Florentine Valley, Timbs Track, m 500, 5.XII.1998, P.M. Giachino leg. (CGi); 1 ♀, Australia, Tas., Mt. Field N.P., Lyrebird Track, m 700, 7.XII.1998, P.M. Giachino leg. (CGi); 1 ♀, Australia, Tas., Strahan, Macquarie Harbour, Gordon River Mouth, 26.I.2002, P.M. Giachino leg. (CGi); 1 ♀, Tas. Mt. Wellington, Lea (SAM).

Diagnosis and redescription

Length mm 4.52-5.26. Body oval (Oodes-like), convex, black and shiny; legs and antennae piceous or piceous red. Head short, with eyes large, round and prominent. Antennae slender, hardly exceeding the base of the pronotum when stretched backwards. Pronotum transverse, widest at the basal 4th; sides regularly arcuate. Base straight, widest than anterior side, with angles obtuse, lightly blunted, not prominent. Basal setae present, anterior marginal setae inserted at the anterior 3rd. Elytra oval, with disc lightly striate; juxtascutellar stria absent; apical recurrent striole short, subrectilinear, ending at the level of 6th stria. Chaetotaxis: juxtascutellar pore present; third interval with two setiferous pores. Aedeagus (Fig. 4) small (length 0.84 mm), with basal bulb small; median lobe, in lateral view, abruptedly curved at the basal 3rd, subrectilinear in apical 2/3. Apex short, pointed and straight. Inner sac medially provided with two copulatory pieces: one like a wide spoon of and one stick-shaped. Parameres large, weak and long, reaching the apical 5th, each provided with 4 apical setae.

Distribution and ecology

S. tasmaniae appears widely distributed throughout Tasmania where it is found by sieving litter in primary forests, at elevations between a few m a.s.l. (Hobart) and 900 m (Hartz Mts, Lake Osborne) (Map 2). This species is also known from Victoria (Warburton), where it was originally described as *Brachydema victoriae* (Sloane 1915) and then placed in synonymy with *Brachydema tasmaniae* (Sloane 1915) by Sloane himself (1920). The comparative study of aedeagi has helped to confirm the synonymy proposed by Sloane (1920).

Genus *Idacarabus* Lea, 1910

Type species: *Idacarabus troglodytes* Lea, 1910
Idacarabus Lea, 1910: 54.
Idacarabus Lea: Sloane, 1920: 139.
Idacarabus Lea: Moore et al, 1987: 123.
Idacarabus Lea: Lorenz, 2005: 201.

Idacarabus cordicollis Moore, 1967

Loc. Typ.: Newdegate Cave, Hasting, Tasmania.
Idacarabus cordicollis Moore, 1967: 179.
Idacarabus cordicollis Moore: Moore et al, 1987: 123.
Idacarabus cordicollis Moore: Lorenz, 2005: 201.

Examined material

1 ♂ 1 ♀, Tasmania, Hastings, King George V Cave, 16.XII.1984, S. Eberhard leg. QVM 12: 43761 (QVML, CGi).

Distribution and ecology

At present, this troglomorphic species is known only from caves in the Hastings karst area, southern Tasmania: Newdegate Cave and King George V Cave (Map 3).

Idacarabus troglodytes Lea, 1910

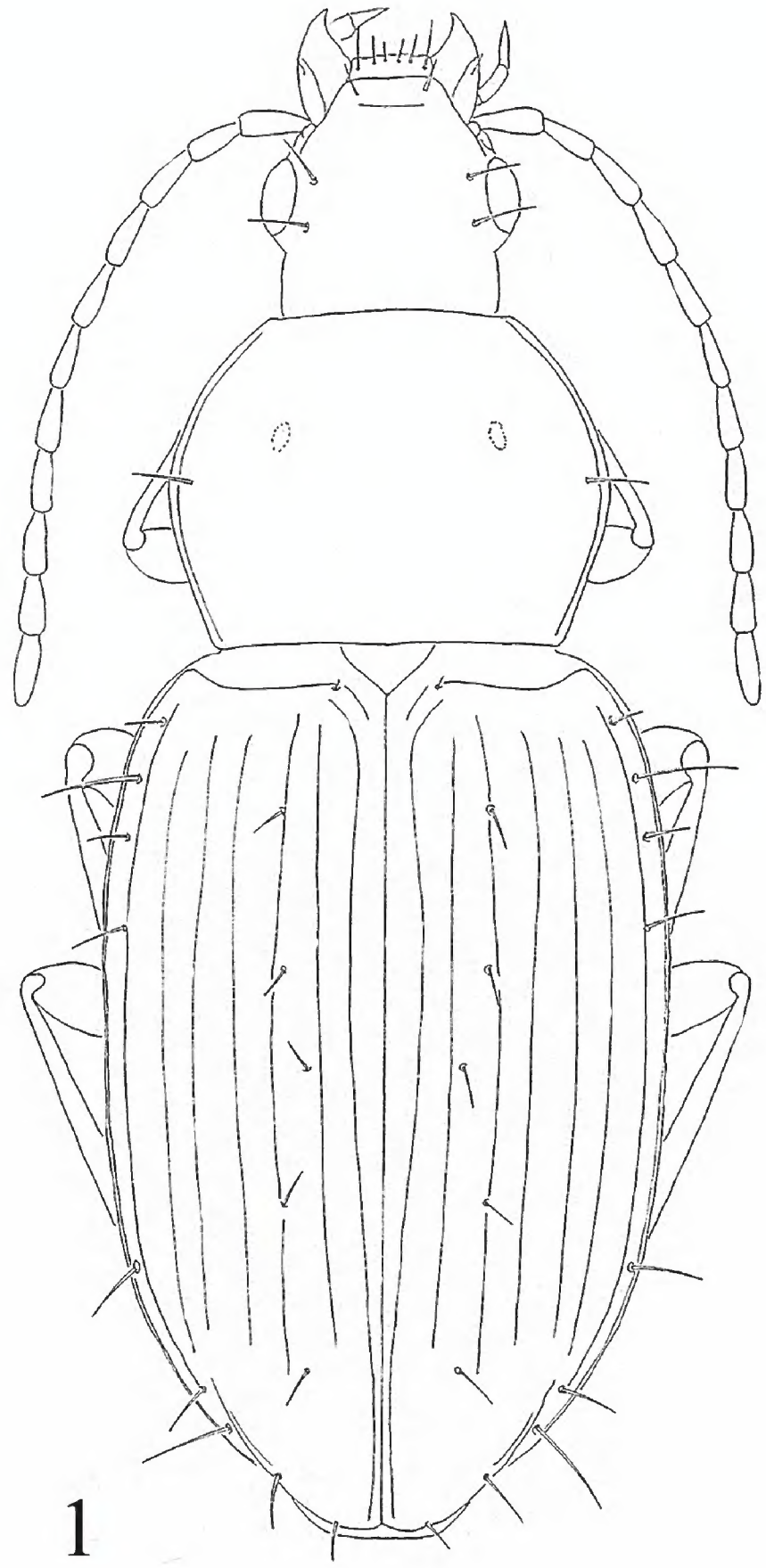
Loc. Typ.: Ida Bay Caves, Tasmania.
Idacarabus troglodytes Lea, 1910: 55.
Idacarabus troglodytes Lea: Moore et al, 1987: 123.
Idacarabus troglodytes Lea: Moore, 1994: 80.
Idacarabus troglodytes Lea: Lorenz, 2005: 201.

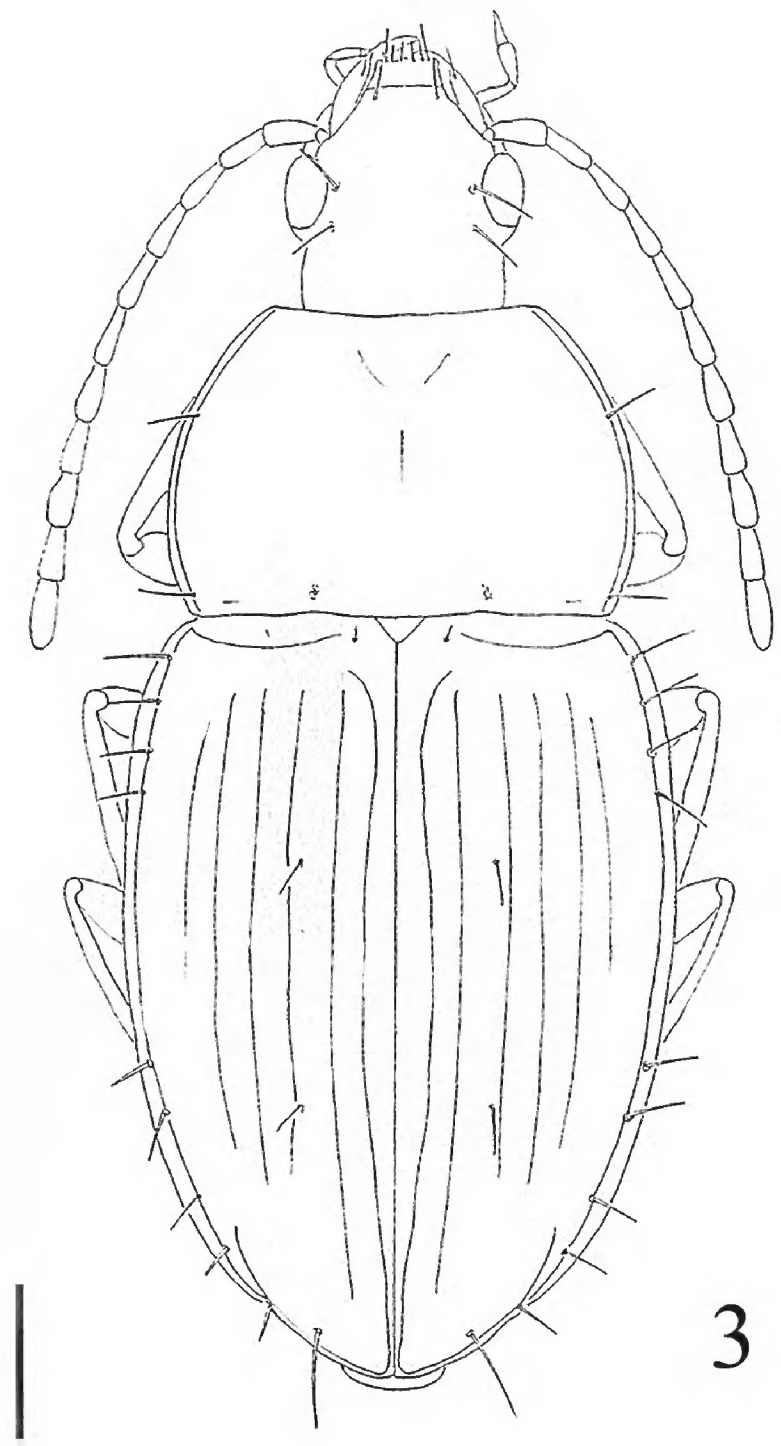
Examined material

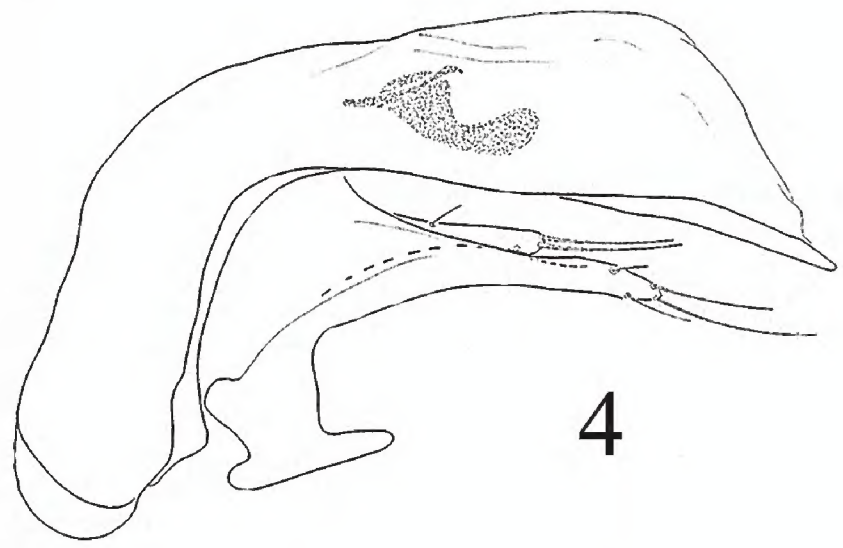
1 ♀, Tasmania, Ida Bay, Exit Cave, 18.VII.1985, S. Eberhard leg., QVM 12: 43759 (QVML); 1 ♀, (remains), Tasmania, Ida Bay, MysteryMystery Creek Cave, 1 Jan. 2009, S. Eberhard leg. (TMH); 2 ♀♀, Hastings, MysteryMystery Creek Cave, 21.I.2002, P.M. Giachino leg. (CGi).

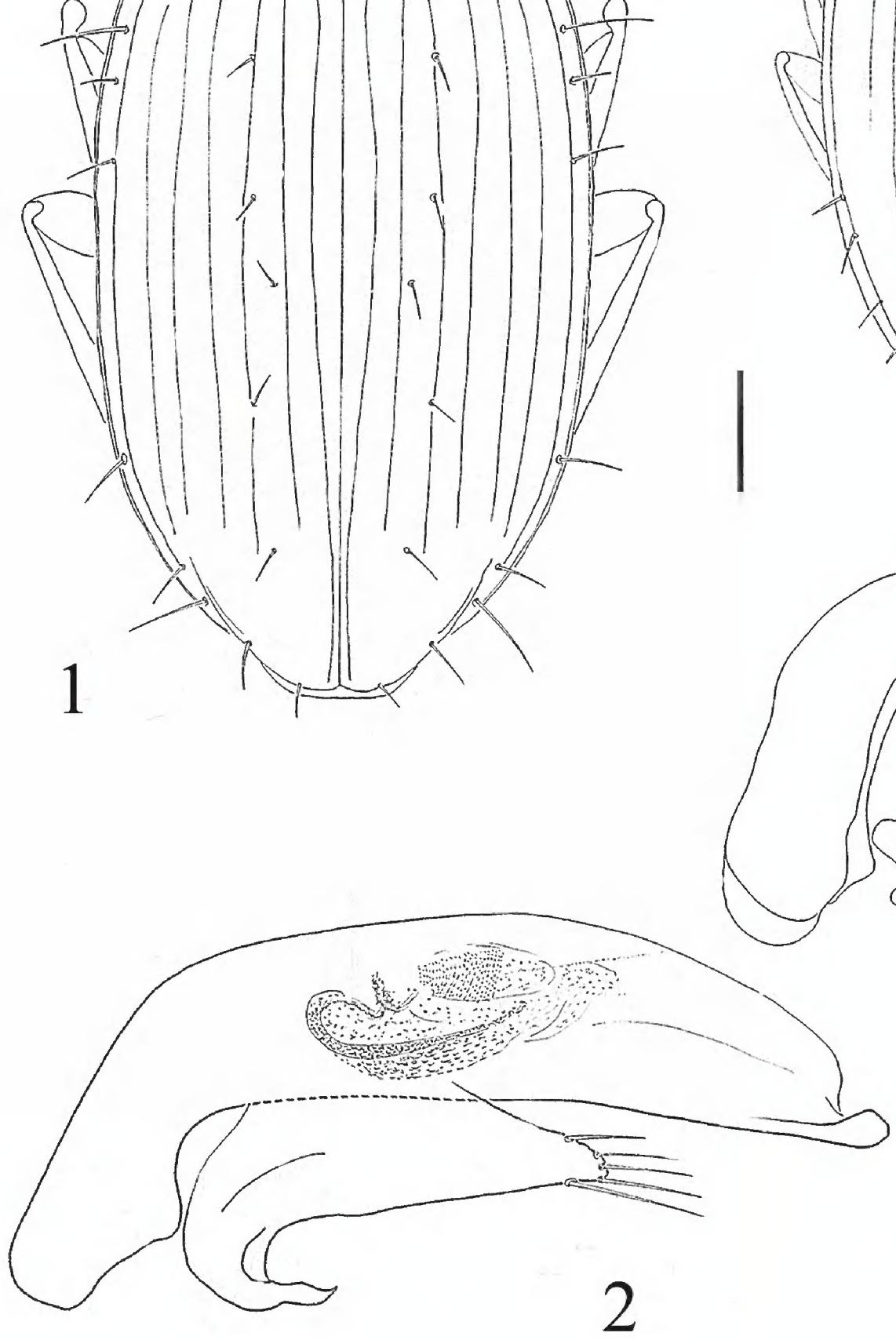
Distribution and ecology

At present, this troglomorphic species is known only from caves in the Ida Bay karst area, southern Tasmania: Exit Cave, Mystery Cave, Revelation Cave, and

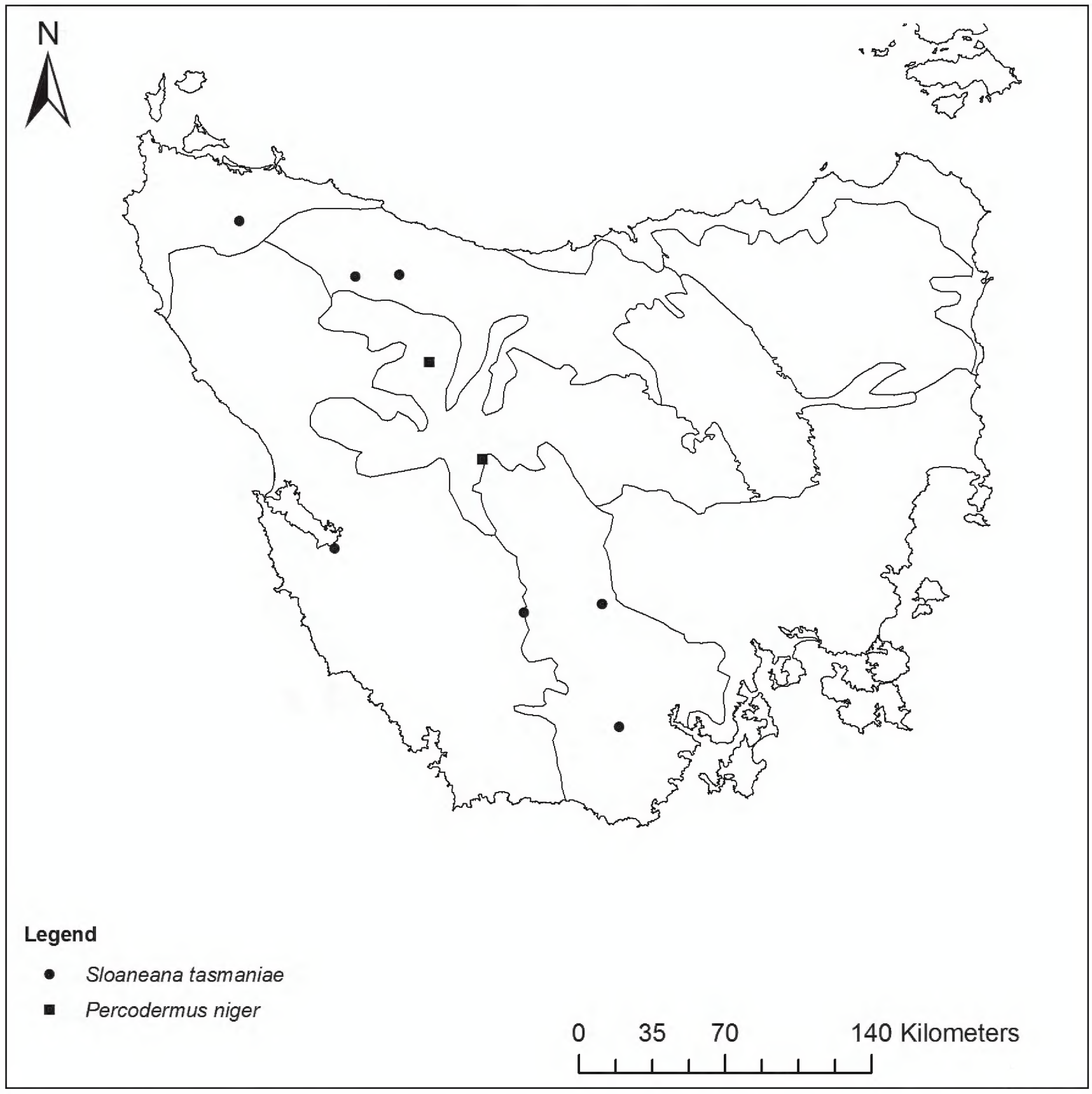








Figs 1-4. *Percodermus niger* Sloane: 1) habitus of ♂ from Lake St. Clair; 2) aedeagus in lateral view of LT from Great Lake. *Sloaneana tasmaniae* (Sloane): 3) habitus of ♂ from Lake St. Clair; 4) aedeagus in lateral view of ♂ from Lake Osborne. Scale: 0.5 mm.



Map 2 - Collection sites for *Percodermus niger* and *Sloaneana tasmaniae*.

numerous other caves (Map 3). The species is common in many caves within this karst area, and its distribution extends from the transition zone to the deep cave zone.

Idacarabus longicollis Moore, 1978

Loc. Typ.: Damper Cave, Precipitous Bluff.
Idacarabus longicollis Moore, 1978: 23.
Idacarabus longicollis Moore: Moore et al, 1987: 123.
Idacarabus longicollis Moore: Lorenz, 2005: 201.

Examined material

1 ♂ 1 ♀, Tasmania, Precipitous Bluff, PB4-10, Cueva Blanca, 21.III.1986, Eberhard leg., QVM 12:43760 (QVML, CGi).

Distribution and ecology

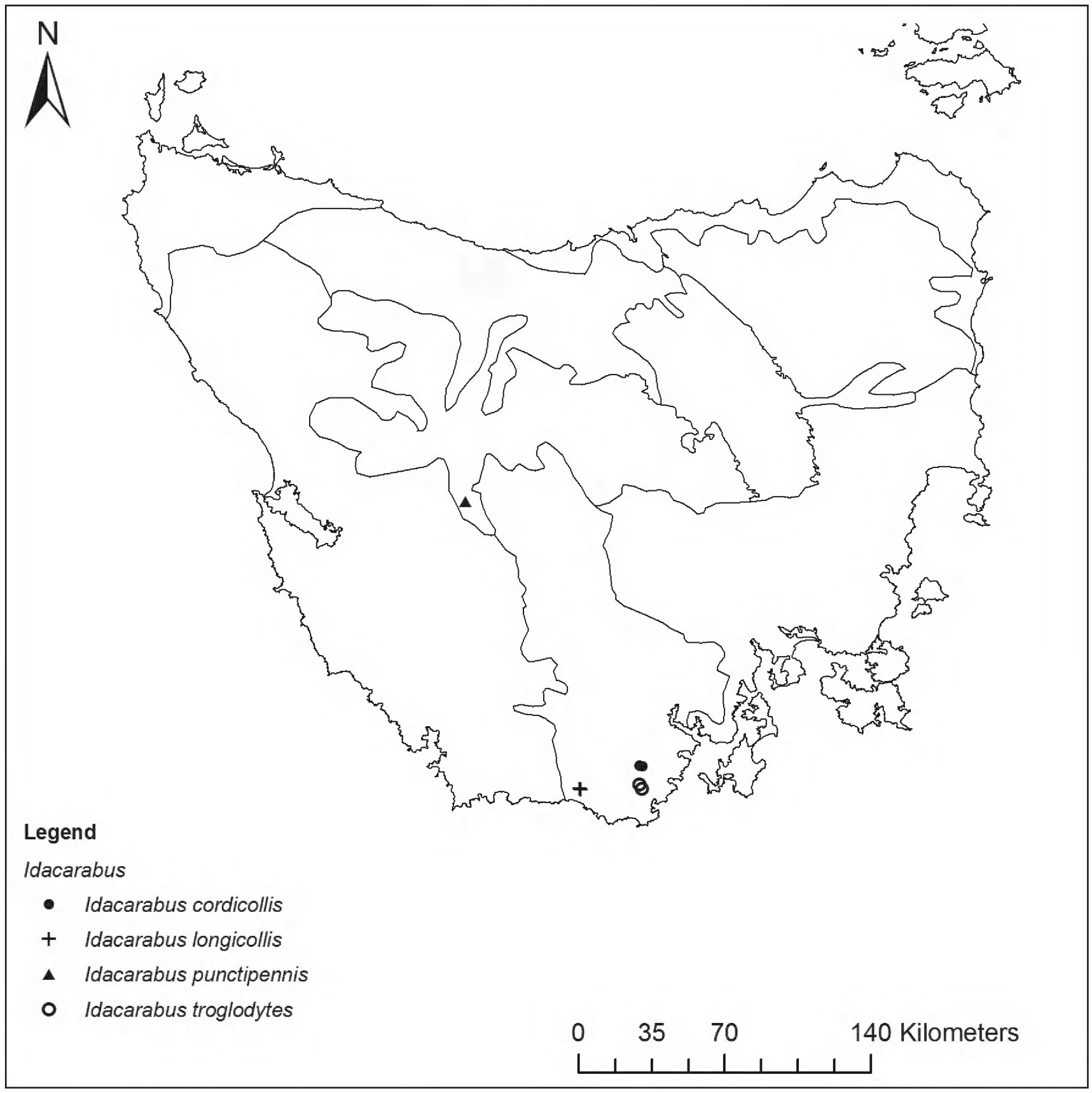
At present, this troglomorphic species is known only from caves in the Precipitous Bluff karst area, southern Tasmania: Damper Cave and Cueva Blanca (Map 3).

Genus *Pterocyrtus* Sloane, 1920

Type species: *Pterocytus globosus* Sloane, 1920.
Pterocyrtus Sloane, 1920: 140.
Pterocyrtus Sloane: Moore et al, 1987: 123.
Pterocyrtus Sloane: Lorenz, 2005: 201.

Key to Tasmanian species

1 Eyes large and convex, prominent 2
- Eyes large or reduced, but flat and not prominent.... 6
2 Pronotum transverse 3
- Pronotum cordiform ..... *P. tasmanicus*
3 Pronotum very transverse about 1.5 times wider than long. Elytra with striae obsolete 4
- Pronotum less transverse about 1.2 –1.3 times wider than long. Elytra decidely striate on disc **5**
4 Bigger (5.5 mm). Sides of pronotum clearly sinuate before basal angles. Basal angles prominent..... ..... *P. globosus*



Map 3 - Collection sites for *Idacarabus* spp.

- Less big (4.75 mm). Sides of pronotum not sinuate before basal angles. Basal angles obtuse, not prominent ..... *P. meridionalis* sp. nov.

5 Pronotum less transverse about 1.2 times wider than long. Sides of pronotum before basal angles from straight to subsinuate. Elytra short and ovoidal .... *P. striatulus*

- Pronotum more transverse about 1.3 times wider than long. Sides of pronotum before basal angles clearly sinuate. Elytra longer and elliptic..... *P. cavicola*

6. Very large (6.48 mm). Pronotum cordiform; sides of pronotum before basal angles straight not sinuate .... *P. grayi* sp. nov.

- Small (3.95-4.0 mm). Pronotum transverse; sides of pronotum before basal angles clearly sinuate .... *P. rubescens*

Pterocyrtus grayi sp. nov.
(Fig. 5)

Loc. Typ.: Tasmania, Gray, Elephant Farm Cave, 41°37'S 148°12'E.

Type series

HT ♀, Tas, 41°37'S 148°12'E, G-X2-11, Gray, Elephant Farm Cave, dark zone, 11.VIII.1988, S. Eberhard leg., QVM 12: 43762 (QVML).

Diagnosis

A black-brown, shiny, large-sized (6.48 mm) *Pterocyrtus*, characterized by eyes not reduced, but flat and poorly protruding, pronotum cordiform with the sides posteriorly subrectilinear and the basal angles sharp and slightly protruding; elitrae ovoidal and globose. From *P.*

tasmanicus, similar for the shape of pronotum and elytra, it differs markedly for the neatly bigger size; from *P. striatulus*, *P. globosus*, *P. meridionalis* sp. nov. and *P. rubescens* it differs, besides the larger size, also for the pronotum cordiform and not transverse. Only from *P. striatulus* it differs also for the elytra with less evident striae. From *P. cavicola*, a species of similar size, it differs finally for the pronotum with sides posteriorly rectilinea, not sinuate, and for the elytra less globose.

Description of HT ♀

Length mm 6.48. Body obovate (Fig. 5), with a very small fore-body in comparison with the elytra, which are short, big, ample and very convex. Dorsal surface glabrous, with microsculpture vanishing, so the surface is shiny. Metathoracic wings absent. Colour blackish brown, with lateral margins of elytra, elytral suture, epipleura, legs, antennae, and palpi reddish brown. Head normal. Clypeus distinctly convex at the base, with one apical seta on each side. Eyes flat and not prominent. Neck constriction evident, well marked also in the dorsal part. Labrum transverse, with a sligthly emarginated apex; mandibles slender. Antennae slender, as long as half of the body. Second antennal segment sligthly longer than the first one. Pronotum cordiform (PW/PL: 1.18), widest at about 2/3 from base. Base usually sligthly wider than the anterior margin. Sides subrectilinear before the base, which is nearly straight, only slightly oblique near the hind angles, which are rectangular and a little projected outwards. Front angles rounded and not advanced. Lateral margins narrow, not widening posteriorly; anterior seta inserted near the middle; basal seta present. Basal foveae smooth, sligthly impressed, subcircular. Median line distinct. Discal surface gently convex. Elytra broad, oval, widest in the middle, very convex. Shoulders rounded but visible, with humeral border continuing inwards almost at the base of 4th stria. Lateral border of elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. From second to seventh stria vestigial, more visible in the basal third of the elytra and reduced to a series of obsolete points progressively. First stria shallow but evident on the whole length; juxtascutellar stria absent; apical recurrent striole short, gently curved, ending at the level of the 6th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; three setiferous pores on the third stria, respectively, at the basal fourth, in the middle and at the apical fourth. Two preapical pores placed backwards and closer to the recurrent striole. Male unknown.

Etymology

From the name of the type locality, located near the village of Gray (NE Tasmania).

Distribution and ecology

P. grayi sp. nov. is currently known only from the type locality, the Elephant Farm Cave, located near the village of Gray (NE Tasmania), where it was collected in winter (August) in the dark zone of the cave (Map 4). *P. grayi* sp. nov., while not presenting any of the typical characters adaptive to the subterranean environment (depigmentation of the body, pronounced eye reduction, significant elongation of appendages), can be seen, within the genus *Pterocyrtus*, as the most specialized species known today. It presents a pronotum no longer transverse but cordiform, a first hint of eye reduction and, most importantly, a significant elongation of the antennae. The rarity of the finds in the cave (and the complete absence of finds in the epigean environment) may indicate a preference toward fissure environments, due to situations of MSS or Superficial Subterranean Habitat sensu Howarth (1983) and Giachino and Vailati (2010).

Pterocyrtus globosus Sloane, 1920

(Figs 6, 11)

Loc. Typ.: Cradle Mts.

Pterocytus globosus Sloane, 1920: 142

Pterocytus globosus Sloane: Moore et al, 1987: 123.

Pterocytus globosus Sloane: Lorenz, 2005: 201.

Type material

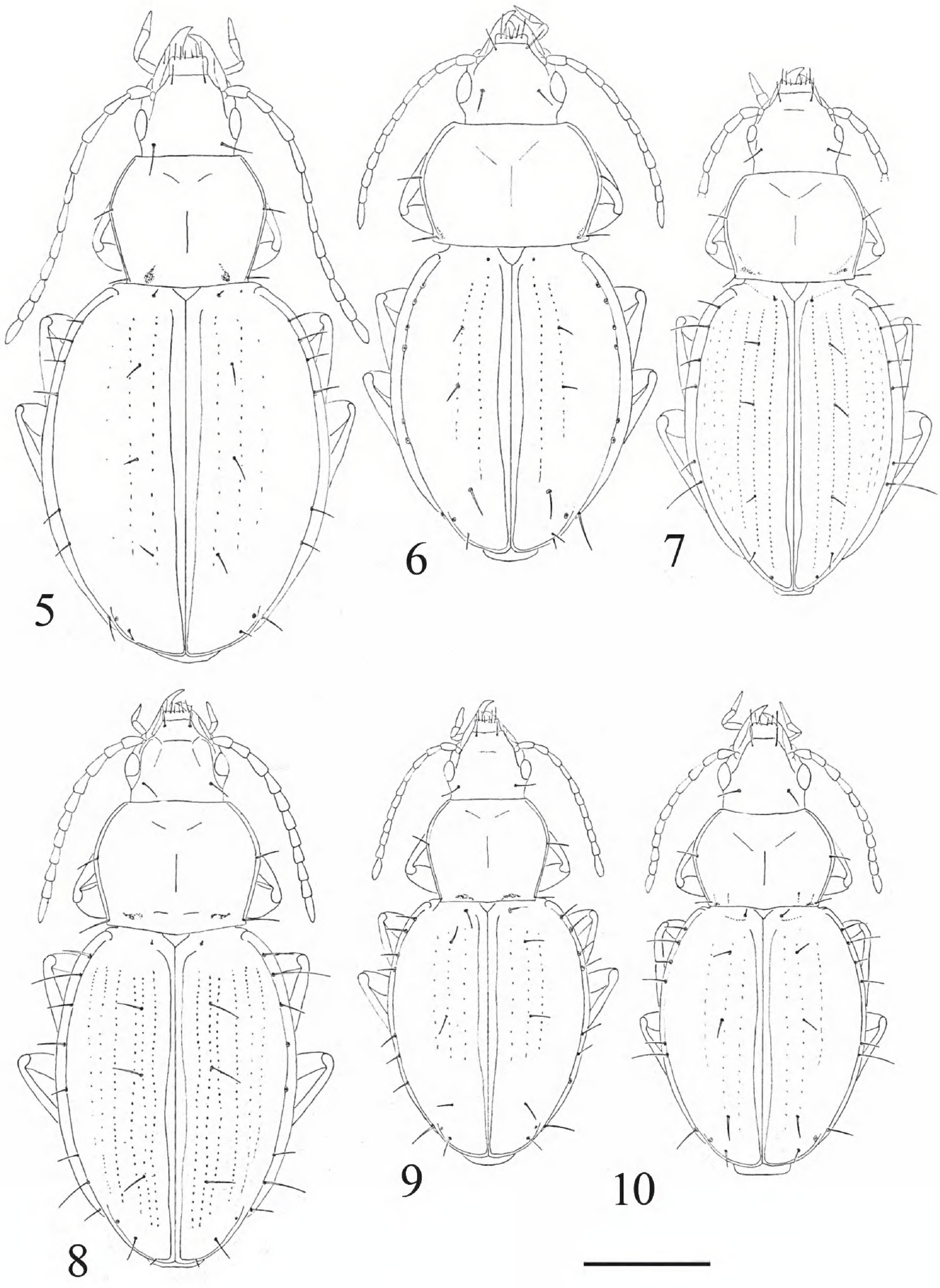
LT ♂ and PLT ♀ (on the same label LT pointed out as 1, PLT pointed out as 2), Cradle Mtn. Tasmania, Carter & Lea (white, printed); Type (white, printed); *Oopterus globosus* Sl. Id. by T.G. Sloane (white, handwritten and printed); I. 7305 *Pterocyrtus globosus* Sl., Tasmania, Type (white, handwritten with black and red writing); Lectoholo- *P. globosus* Sl. P.J.D. (red, handwritten); Lectotypus ♂ (1) *Pterocyrtus globosus* Sloane P.M. Giachino des. 2009 (red, handwritten and printed); Paralectotypus ♀ (2) *Pterocyrtus globosus* Sloane P.M. Giachino des. 2009 (red, handwritten and printed) (SAM).

Examined material

2 ♀♀, Tas, 42°40'S 146°27'E, Junee-Florentine Windy Rift, Growling Swallet Cave, 26.III.1989, S. Eberhard leg., QVM 12: 43764 (QVML, CGi).

Diagnosis and redescription

A brown black, shiny, small-sized (4.3-5.0 mm) *Pterocyrtus*, characterized by big, convex, and prominent eyes, pronotum very transverse with the sides sinuate posteriorly, and basal angles right and protruding. Elytra broad, oval, widest in the middle, very convex. Second stria vestigial and reduced to a series of points; 3rd to 7th stria obsolete; first stria shallow but evident on the whole length; juxtascutellar stria absent; apical recurrent striole short, gently curved, ending at the level of the 6th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; three setiferous pores on the third stria, respectively, at the basal 4th, a little behind the middle and at the apical 5th. Two preapical pores placed backwards and closer to the recurrent striole. Aedeagus (Fig. 11) large (length 0.85 mm), long, stout, very compressed



Figs 5-10. Habitus of *Pterocyrtus* spp.: 5) *P. grayi* sp. nov., HT ♀ from Elephant Farm Cave; 6) *P. globosus* Sloane, LT ♂ from Cradle Mtn.; 7) *P. rubescens* Sloane, HT ♂ from Waratah; 8) *P. striatulus* Sloane, LT ♂ from Cradle Mtn.; 9) *P. tasmanicus* (Castelnau), ♂ from Tasmania; 10) *P. meridionalis* sp. nov., HT ♂ from Lake Osborne. Scale: 1 mm.

laterally, with basal bulb broadly opened; median lobe, in lateral view, very long, curved in the basal 3rd, subrectilinear in the distal 3rd; apex short, with the apical blade bold and rounded. Inner sac without the copulatory piece. Parameres long and narrow, reaching the apical 3rd of the median lobe, each provided with 5 setae.

Distribution and ecology

P. globosus is known, as a typical element of forest litter, from Cradle Mts. (type locality) and Waratah (Sloane, 1920; Moore et al, 1987). The collection of this non-troglomorphic species deep inside Growling Swallet Cave is most likely a result of the specimens being washed underground during regular flooding, however this record expands the known distribution for this species considerably southwards (Map 4).

Pterocyrtus rubescens Sloane, 1920
(Figs 7, 12)

Loc. Typ.: Waratah
Pterocytus rubescens Sloane, 1920: 142
Pterocytus rubescens Sloane: Moore et al, 1987: 124.
Pterocytus rubescens Sloane: Lorenz, 2005: 201.

Type material

HT ♂, Waratah T. H.S.O. 1.18 (white, handwritten); *Oopterus rubescens* Sl. Id. by T.G. Sloane (white, handwritten and printed); Type (white, printed); *Pterocyrtus rubescens* Sl. Tasmania, I. 10805, Type (white, handwritten with black and red writing); Lectoholo- *P. rubescens* Sl. P.J.D. (red, handwritten) (SAM).

Examined material

4 ♂♂ 1 ♀, Waratah, Tas. Lea (SAM, CGi).

Diagnosis and redescription

A reddish brown, shiny, small-sized (3.95-4.0 mm) *Pterocyrtus*, characterized by small, flat, poorly prominent eyes, pronotum transverse with sides sinuate posteriorly, and basal angles right and not protruding. Elytra broad, elliptical, widest in the middle, very convex. All striae evident and pointed; juxtascutellar stria absent; apical recurrent striole short, gently curved, ending at the level of the 6th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; three setiferous pores on the third stria, respectively, at the basal 5th, a little behind the middle and at the apical 4th. Two preapical pores placed backwards and closer to the recurrent striole. Aedeagus (Fig. 12) large (length 0.94 mm), long, stout, very compressed laterally, with the basal bulb broadly opened; median lobe, in lateral view, very long, abruptedly curved in the basal 6th, subrectilinear in the distal 5/6; apex short, with the apical blade attenuate and broadly rounded. Inner sac with two small, copulatory pieces. Parameres long and narrow, reaching the apical 3rd of the median lobe, each one provided with 5 setae.

Distribution and ecology

P. rubescens is known only from the type locality of Waratah in NW Tasmania (Map 4). Moore et al (1987) mention it as an element of the forest litter.

Pterocyrtus striatulus (Sloane, 1920)
(Figs 8, 13)

Loc. Typ.: Cradle Mts.
Pterocytus striatulus Sloane, 1920: 141.
Pterocytus striatulus Sloane: Moore et al, 1987: 124.
Pterocytus striatulus Sloane: Lorenz, 2005: 201.

Type material

LT ♂ and PLT ♀ (on the same label LT pointed out as 1, PLT pointed out as 2), Cradle Mtn. Tasmania, Carter & Lea (white, printed); Type (white, printed); *Oopterus striatulus* Sl. Id. by T.G. Sloane (white, handwritten and printed); I. 10804 *Pterocyrtus striatulus* Sl., Tasmania, Type (white, handwritten with black and red writing); Lectoholo- *P. striatulus* Sl. P.J.D. (red, handwritten); Lectotypus ♂ (1) *Pterocyrtus striatulus* Sl. P.M. Giachino des. 2009 (red, handwritten and printed); Paralectotypus ♀ (2) *Pterocyrtus striatulus* Sl. P.M. Giachino des. 2009 (red, handwritten and printed) (SAM).

Examined material

1 ♂, NW Tas., Parawee, Jan. 1997 (CGi); 1 ♂, Parawee NW Tas., Dec. 1936 (CGi); 1 ♀ immature (without certain determination), Tas., 42°52'S 147°15'E, WE-X1-4, Mount Wellington, Mount Arthur Cave 1, in litter, 7.II.1989, S. Eberhard leg., QVM 12: 43765 (QVML); 1 ♀, Tasmania, Zeehan (SAM).

Diagnosis and redescription

A brown black, shiny, big-sized (5.0-5.5 mm) *Pterocyrtus*, characterized by big and prominent eyes, pronotum slightly transverse with sides subrectilinear posteriorly, and basal angles right and slightly protruding. Elytra broad, elliptical, widest in the middle, very convex. All striae evident and pointed; juxtascutellar stria absent; apical recurrent striole short, gently curved, ending at the level of the 6th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; three setiferous pores on the third stria, respectively, at the basal 4th, a little behind the middle and at the apical 4th. Two preapical pores placed backwards and closer to the recurrent striole. Aedeagus (Fig. 13) small (length 0.59 mm), stout, very compressed laterally, with the basal bulb broadly opened; median lobe, in lateral view, short, slightly curved in the basal 3rd, gently curved in the distal 2/3; apex short, with the apical blade attenuate and broadly rounded. Inner sac with a small, bifid, copulatory piece. Parameres short and stout, reaching the apical 3rd of the median lobe, each one provided with 5 setae.

Distribution and ecology

The type locality of *P. striatulus* is Cradle Mts. (Sloane, 1920), the indication by Moore et al (1987) from Bottomless Pit in the Gray karst in NE Tasmania needs confirmation (Map 4). In fact, in the same area there is *P. grayi* sp. nov. Conversely the specimens studied from Parawee and Zeehan (not very far from the type locality) are fully compliant with the type. Also the record of the site of Mt Wellington needs to be confirmed (very distant from the known range of this species) and identified on a single extremely immature female.

Pterocyrtus cavicola Moore, 1994

Loc. Typ.: Nicholls Range, Bill Nielson Cave.
Pterocyrtus cavicola Moore, 1994: 77.
Pterocyrtus cavicola Moore: Lorenz, 2005: 201.

Examined material

1 ♀, Tasmania, Franklin River, Gahnia Cave, 20.III.1989, S. Eberhard leg. QVM 12: 43763 (QVML); 2 ♀♀, Tasmania, Gordon River, Bill Nielson Cave, 4032300E 5271300N, 18.4.2009, R. Eberhard leg. (TMH).

Notes

The description, but above all the drawings of the habitus and of the aedeagus, given by Moore (1994) in his description, are sufficiently accurate; therefore no further additions are necessary.

Distribution and ecology

This weakly troglomorphic but probably obligate subterranean species is known from two caves located in the Gordon-Franklin Rivers karsts of SW Tasmania: Bill Nielson Cave located in Nicholls Range karst (type locality of this species) and Gahnia Cave in the Franklin River karst (Map 4).

Pterocyrtus tasmanicus (Castelnau, 1867)

(Figs 9, 14)

Loc. Typ.: Tasmania
Drimostoma tasmanica Castelnau, 1867: 113.
Pterocyrtus (Drimostoma) tasmanicus Castelnau: Sloane, 1920: 142.
Pterocyrtus tasmanicus (Castelnau): Moore et al, 1987: 124.
Pterocyrtus tasmanicus (Castelnau): Lorenz, 2005: 201.

Examined material

1 ♂ 1 ♀, Tasm[a], Simson, Fry Coll. 1900.100 (sub *Oopterus tasmanicus* Cast.) (BMNH); 2 ♀♀ Launceston Tasmania 91-83 (sub *Drimostoma tasmanicum* Cast., id by T. G. Sloane) (BMNH); 1 ♀, Blue Tier (SAM).

Diagnosis and redescription

A black, shiny, small-sized (3.2-4.2 mm) *Pterocyrtus*, characterized by big and prominent eyes, pronotum cordiform with sides subrectilinear posteriorly, and basal angles obtuse and not protruding. Elytra broad, oval, widest at the anterior 3rd, very convex. Second stria vestigial and reduced to a series of points; 3rd to 7th stria obsolete; first stria shallow but evident on the whole length; juxtascutellar stria absent; apical recurrent striole short, gently curved, ending at the level of the 6th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; three setiferous pores on the third stria, respectively, at the basal 6th, a little behind the middle, and at the apical 5th. Two preapical pores placed backwards and closer to the recurrent striole. Aedeagus (Fig. 14) small (length 0.68 mm), delicate, very compressed laterally, with the basal bulb broadly opened; median lobe, in lateral view, slightly curved in the basal 4th, gently curved in the distal 2/3; apex short, with the apical blade attenuate. Inner sac without the copulatory piece. Parameres long and narrow, reaching the half of the median lobe, each one provided with 5 setae.

Distribution and ecology

Sloane (1920) and Moore et al (1987) mention it from Blue Tier, as a typical litter element (Map 4).

Pterocyrtus meridionalis sp. nov.

(Figs 10, 15)

Loc. Typ.: Tasmania, Hartz Mts. National Park, Lake Osborne.

Type series

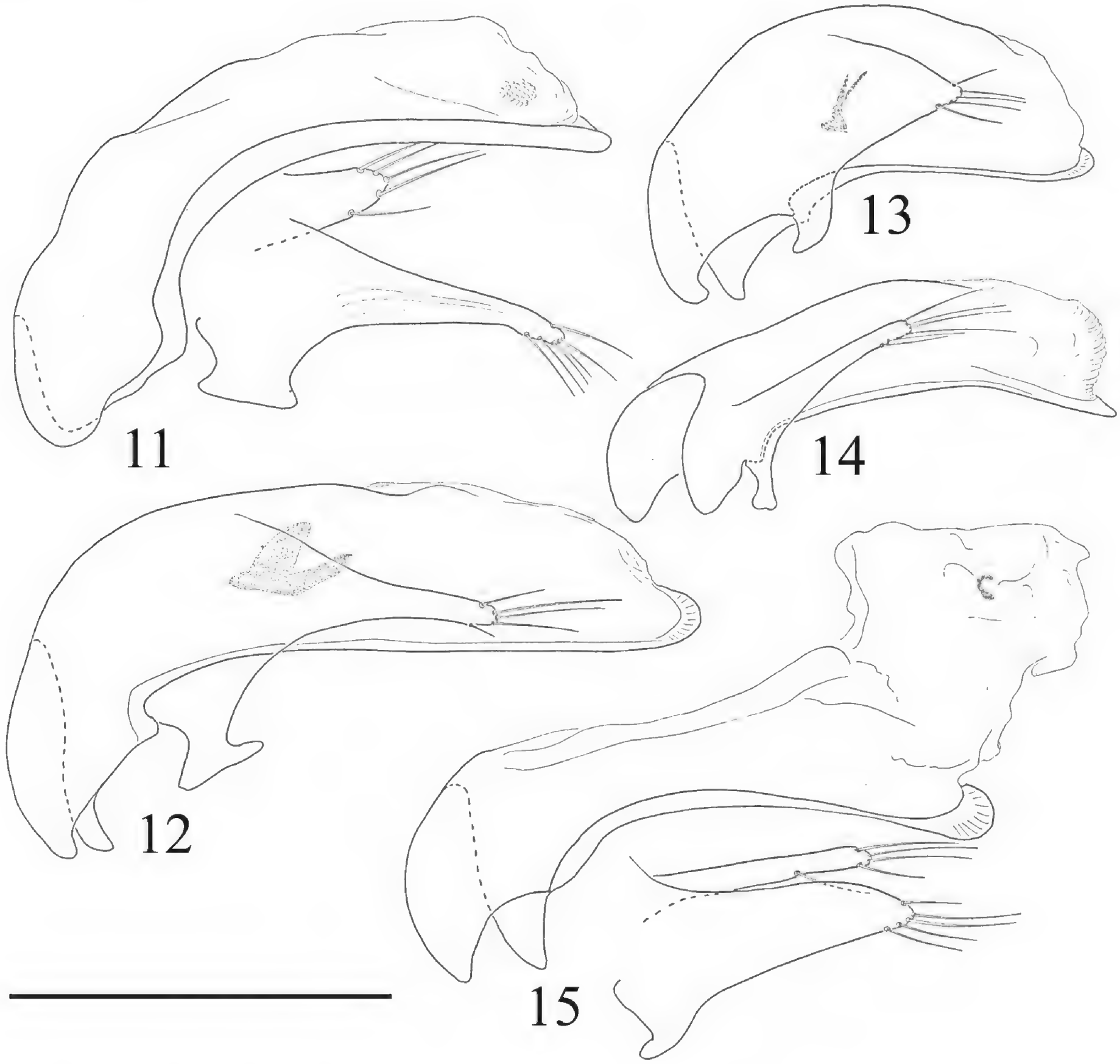
HT ♂, Australia, Tas., Hartz Mts. N.P., Lake Osborne Jan. 1997 (CGi);

Diagnosis

A black brown, shiny, small (4.75 mm) *Pterocyrtus*, characterized by big and prominent eyes, pronotum transverse with the sides subrectilinear posteriorly, and basal angles obtuse and not protruding; elytra oval and globose. It differs from *P. tasmanicus*, similar in size, in the transverse pronotum; from *P. rubescens* it differs by the larger size, the more transverse pronotum, and by the elytra more oval, less elongated; it differs from *P. striatulus*, *P. globosus*, *P. grayi* sp. nov., and *P. cavicola* in the smaller size. Finally, it differs only from *P. grayi* sp. nov. for the significantly transverse pronotum.

Description of HT ♂

Length mm 4.75. Body obovate (Fig. 10), with a small fore-body in comparison with the elytra, which are short, ovate and very convex. Dorsal surface glabrous, with the microsculpture vanishing, so the surface is shiny. Metathoracic wings absent. Colour blackish brown, with lateral margins of the elytra, elytral suture, epipleura, legs, antennae, and palpi reddish brown. Head normal. Clypeus distinctly convex at the base, with one apical setae on each side. Eyes convex and prominent. Neck constriction less evident, but marked also in the dorsal part.



Figs 11-15. Aedeagus in lateral view of *Pterocyrtus* spp.: 11) *P. globosus* Sloane, LT ♂ from Cradle Mtn.; 12) *P. rubescens* Sloane, HT ♂ from Waratah; 13) *P. striatulus* Sloane, LT ♂ from Cradle Mtn.; 14) *P. tasmanicus* (Castelnau), ♂ from Tasmania; 15) *P. meridionalis* sp. nov., HT ♂ from Lake Osborne. Scale: 0.5 mm.

Labrum transverse, with a sligthly emarginated apex; mandibles slender. Antennae short and slender, less long than a half of the body. Second antennal segment as long as the first one. Pronotum transverse (PW/PL: 1.53), widest at about 2/3 from base. Base usually wider than the anterior margin. Sides not sinuate before the base, which is nearly bisinuate, subrectilinear near the hind angles, which are obtuse and not projected outwards. Front angles rounded and not advanced. Lateral margins narrow, not widening posteriorly; anterior seta inserted near the middle; basal seta present. Basal foveae smooth, very impressed, subcircular. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra broad, oval, widest in the middle, very convex. Shoulders rounded but well visible, with the humeral border continuing inwards almost to the base of the 4th stria. Lateral border of elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Second stria vestigial and reduced to a series of points; from 3rd to 7th stria obsolete; first stria shallow but evident on the whole length; juxtascutellar stria absent; apical recurrent striole short, gently curved, ending at the level of the 6th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; three setiferous pores on the third stria, respectively at the basal 5th, a little behind the middle, and at the apical 5th. Two preapical pores placed backwards and closer to the recurrent striole. Aedeagus (Fig. 15) small (length

0.79 mm), delicate, very compressed laterally, with the basal bulb broadly opened; median lobe, in lateral view, slightly curved in the basal third, from gently curved to subrectilinear in the distal 2/3; apex short, stout, with the apical blade attenuate, broadly rounded. Inner sac apically provided with a small C-shaped copulatory piece. Parameres long, reaching the apical third of the median lobe: the left one broad, the right one narrow; each one provided with 5 setae.

Etymology

The specific name wants to underline that this species has a more southern distribution.

Distribution and ecology

P. meridionalis sp. nov. is currently known only from the type locality, Lake Osborne in the Hartz Mts. National Park (S Tasmania), where it was collected in summer (January) (Map 4). There are no other known data on the way of collecting. Investigations, sometimes in search of other specimens and conducted personally by one of the authors (PMG) at Lake Osborne at a height of 900 m a.s.l. in January 2002, were fruitless. For the general morphology of the body (small, stocky, pigmented, with short legs and antennae, and big eyes) *P. meridionalis* sp. nov. could be a typical element of the forest litter.

Trechini Bonelli, 1810
Trechodina Jeannel, 1926
Genus *Trechobembix* Jeannel, 1926
Type species: *Trechus baldiensis* (Blackburn 1894)
Trechobembix Jeannel, 1926: 506.
Trechobembix Jeannel: Moore, 1972: 6.
Trechobembix Jeannel: Casale & Laneyrie, 1982: 37.
Trechobembix Jeannel: Moore et al, 1987: 125.
Trechobembix Jeannel: Lorenz, 2005: 166.

Trechobembix baldiensis baldiensis (Blackburn 1894)
Loc. Typ.: Mt. Baldi, Victoria.
Trechus baldiensis Blackburn, 1894: 88.
Trechobembix baldiensis Blackburn: Jeannel, 1926: 508.
Trechobembix baldiensis (Blackburn): Moore, 1972: 6.
Trechobembix baldiensis (Blackburn): Casale & Laneyrie, 1982: 37.
Trechobembix baldiensis (Blackburn): Moore et al, 1987: 125.
Trechobembix baldiensis (Blackburn): Lorenz, 2005: 166.

Examined material

1 ♂, Australia, Tas., Lake St. Clair N.P., L. St. Clair, m 740, 22.I.2002, P.M. Giachino leg. (CGi); 1 ♀, Australia, Tas., South Arthur Forest, Tayatea Rd., river, 29.I.2002, P. M. Giachino leg. (CGi); 2 ♂♂ 2 ♀♀, Australia, Tas., Lake St. Clair N.P., L. St. Clair, m 700, 29.XI.1998, P.M. Giachino leg. (CGi).

Notes

The drawings provided by Jeannel (1926) and Moore (1972) are sufficiently comprehensive and it is not necessary to make them again.

Distribution and ecology

T. baldiensis, a widespread species in Australia (Moore et al 1987), is known from different additional habitats in Tasmania (Map 5). Based on personal observations by one of the authors (PMG) *T. baldiensis* populates the banks of lakes and wetlands, which are characterized by a sandy-pebble substrate.

Genus *Cyphotrechodes* Jeannel, 1926
Type species: *Trechodes gibbipennis* Blackburn, 1901
Cyphotrechodes Jeannel, 1926: 480.
Cyphotrechodes Jeannel: Moore, 1972: 11.
Cyphotrechodes Jeannel: Casale & Laneyrie, 1982: 37.
Cyphotrechodes Jeannel: Moore et al, 1987: 125.
Cyphotrechodes Jeannel: Lorenz, 2005: 166.

Cyphotrechodes gibbipennis (Blackburn 1901)
Loc. Typ.: Lake district, Tasmania.
Trechodes gibbipennis Blackburn, 1901: 119.
Cyphotrechodes gibbipennis Blackburn: Jeannel, 1926: 482.
Cyphotrechodes gibbipennis (Blackburn): Moore, 1972: 11.
Cyphotrechodes gibbipennis (Blackburn): Casale & Laneyrie, 1982: 37.
Cyphotrechodes gibbipennis (Blackburn): Moore et al, 1987: 125.
Cyphotrechodes gibbipennis (Blackburn): Lorenz, 2005: 166.

Examined material

2 ♂♂ 1 ♀, Australia, Tas., Lake St. Clair N.P., L. St. Clair, m 740, 22.I.2002, P.M. Giachino leg. (CGi).

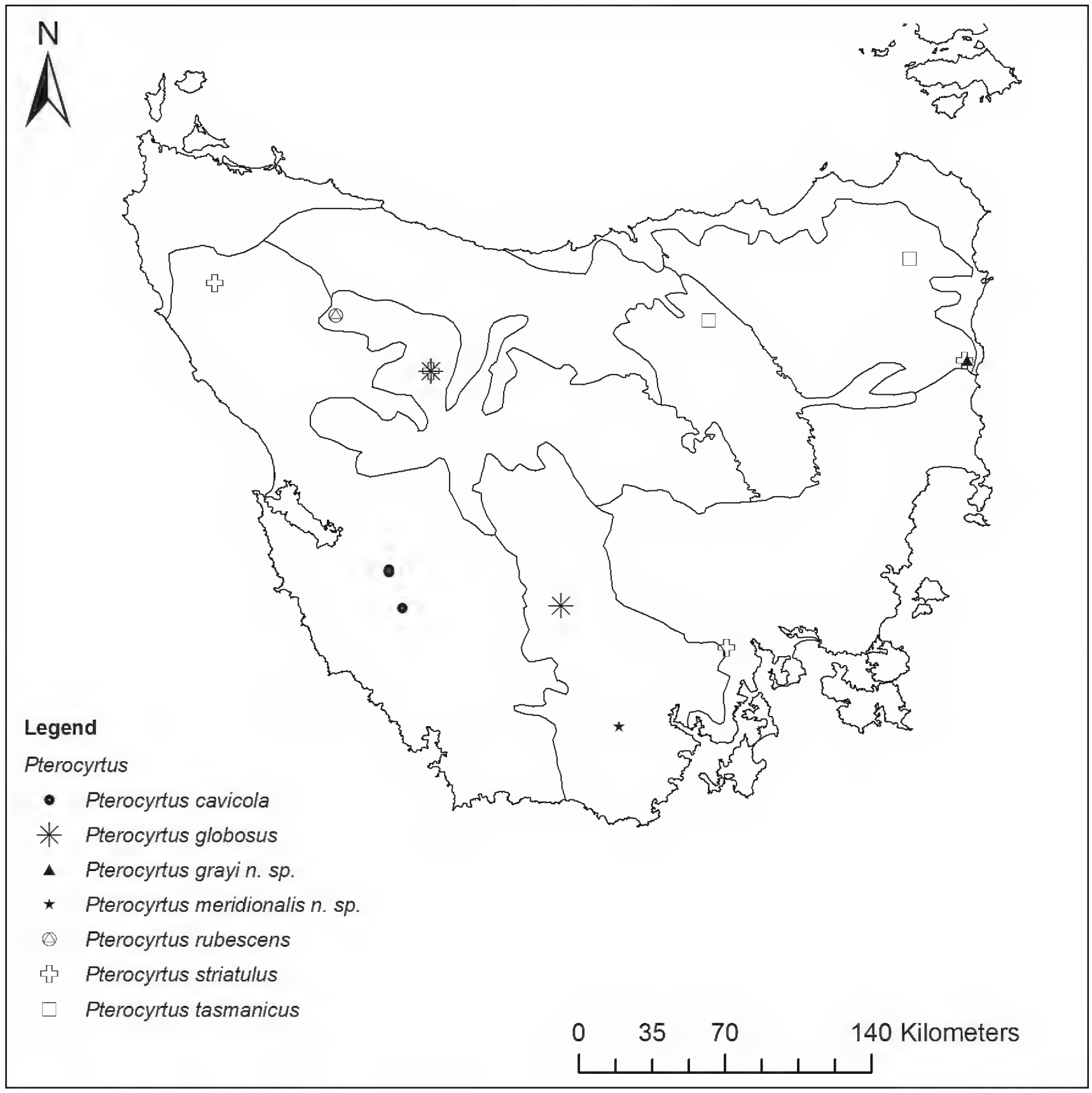
Notes

The drawings supplied by Jeannel (1926) are sufficiently detailed and it is not necessary to make them again.

Distribution and ecology

This species is known in Tasmania from different localities: Lake district, Hartz Mountains. Lake St. Clair, N of Zeehan (Moore 1972) (Map 5). Based on personal observations by one of the authors (P.M.G.) *C. gibbipennis* populates the banks of lakes and swampy areas, but on a sandy-pebble substrate.

Trechina Bonelli, 1810
Genus *Tasmanorites* Jeannel, 1927
Type species: *Trechus nitens* Putzeys, 1974
Tasmanorites Jeannel, 1927: 71.
Tasmanorites Jeannel: Moore, 1972: 15.

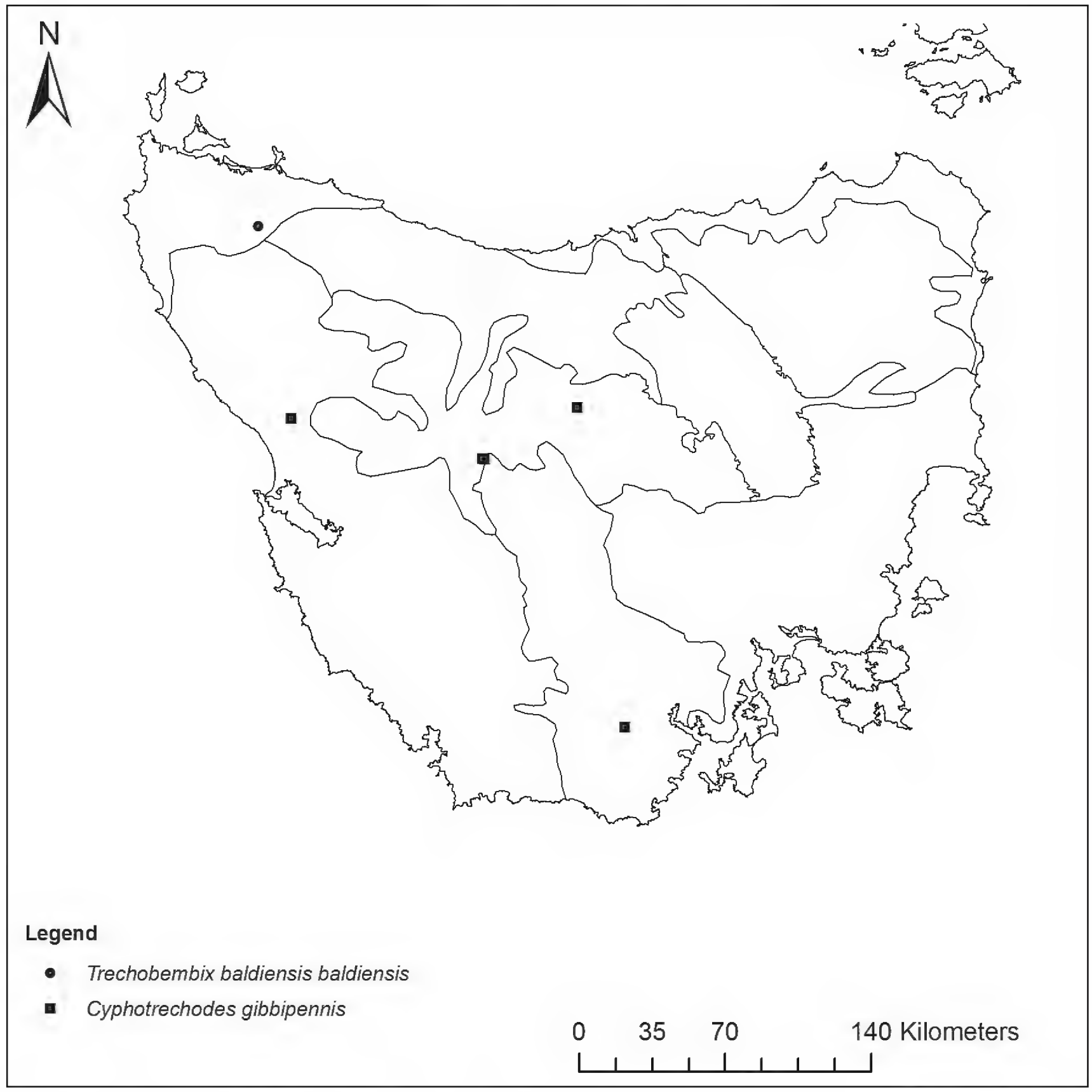


Map 4 - Collection sites for *Pterocyrtus* spp.

Tasmanorites Jeannel: Casale & Laneyrie, 1982: 59.
Tasmanorites Jeannel: Moore, 1983: 1.
Tasmanorites Jeannel: Moore et al, 1987: 126.
Tasmanorites Jeannel: Donabauer, 2001: 101.
Tasmanorites Jeannel: Lorenz, 2005: 168.

Key to species (after Moore, 1972 and Donabauer, 2001 modified)

1 Third interval with only 2 setiferous pores 2
- Third interval with 3 or more such pores 4
2 Eyes very reduced ..... *T. microphthalmus* sp. nov.
- Eyes of normal size 3
3 Pronotal hind angle more marked and notably reflexed, asetose; size bigger (length 5-6 mm)..... ..... *T. grossus*
- Pronotal hind angle rounded, slightly reflexed, basal seta present; size smaller (length about 4.5 mm) ..... *T. madidus*
4 Elytra maculate..... 5
- Elytra immaculate 9
5 Head and pronotum mostly pale; base of pronotum bisinuate ..... *T. riparius*
- Head and pronotum dark; base of pronotum subrectilinear..... 6
6 Side of pronotum sinuate, hind angles sharp..... 8
- Side of pronotum not sinuate, hind angles rounded ..7
7 Size smaller (length 3.18-3.35 mm); elytra short with bigger maculae; 3rd elytral pore placed more backward..... *T. beatricis* sp. nov.
- Size bigger (length 3.7-4.0 mm); elytra long with smaller maculae; 3rd elytral pore placed less backward..... *T. brevinotatus*



Map 5 - Collection sites for *Trechobembix baldiensis baldiensis* and *Cyphotrechodes gibbipennis.*

8 Size bigger (length about 5.5 mm); elytra pyriform... .... *T. elegans*
- Size smaller (length about 5.5 mm); elytra subrectangular..... *T. longinotatus*
9 Base of pronotum wider than the anterior margin..... ..... *T. laticollis*
- Base of pronotum as wide as, or less wide than the anterior margin 10
10 Pronotal hind angles well marked, moderately prominent 11
- Pronotal hind angles rounded, not marked..... 17
11 7th interval with setiferous pores..... *T. aberrans*
- 7th interval without setiferous pores 12
12. Elytra ovoid, broad at the base, humeri marked ... 13
- Elytra pyriform, narrow at the base, humeri obsolete.. 16
13 Pronotal hind angles acute and turned out 14
- Pronotal hind angles obtuse, scarcely projecting .... *T. austrinus*
14 Size bigger (length about 5 mm)..... *T. magnus*
- Size smaller (length about 3.19-3.5 mm)..... 15
15 Pronotum more transverse, antennae short, eyes bigger..... *T. lynceorum* sp. n**ov.**
- Pronotum less transverse, antennae long, eyes smaller..... *T. nitens*
16 Posterior pronotal marginal seta present; 4 inner striae strong ..... *T. flavipes*
- Posterior pronotal marginal seta missing; only 2 inner striae strong ..... *T. cordicollis*
17 Size bigger (length about 3.5-4.1 mm)..... 18
- Size smaller (length about 3.0-3.3 mm)..... 20
18 Antennae longer, reaching the anterior 4th of the elytra; hind angle of pronotum less marked..... 19

- Antennae shorter, not reaching the anterior 4th of the elytra; hind angle of pronotum more marked..... ..... *T. glaebarum*

19 Median lobe of the aedeagus, in lateral view, more curved also in the apical half..... *T. blackburni*
- Median lobe of the aedeagus, in lateral view, less curved, subrectilinear in the apical half... *T. intermedius*

20 Elytra with 3 inner striae lightly impressed 22
- Elytra with 3-4 inner striae strongly impressed 21

21 Base of the pronotum wider; elytra longer; apex of the median lobe of the aedeagus, in lateral view, pointed.. ..... *T. tasmaniae*
- Base of the pronotum less wide; elytra shorter; apex of the median lobe of the aedeagus, in lateral view, rounded..... *T. daccordii* sp. nov.

22 Aedeagus relatively shorter, apex only very slightly upturned..... *T. pullus*
- Aedeagus very elongated, apex clearly upturned..... ..... *T. perkini*

Tasmanorites grossus Moore, 1972
(Figs 16, 19)

Loc. Typ.: Hartz Mountain, SE Tasmania
Tasmanorites grossus Moore, 1972: 16.
Tasmanorites grossus Moore: Casale & Laneyrie, 1982: 59.
Tasmanorites grossus Moore: Moore et al, 1987: 127.
Tasmanorites grossus Moore: Lorenz, 2005: 168.

Examined material

1 ♀, Australia, Tas., Hastings, Mystery Creek Cave, 2.I.2002, P.M. Giachino leg. (CGi); 1 ♂, Australia, Tas., Hartz Mts. N.P., Lake Osborne car park, m 900, 20.I.2002, rainforest, P.M. Giachino leg. (CGi); 2 ♂♂, Nat. Park, Tas., Jan. 1933, F.E. Wilson, 3500' altitude (MVM, CGi).

Notes

The original description by Moore (1972) is sufficiently accurate and does not need any additions, but here we contribute a drawing of the habitus (Fig. 16) and aedeagus (Fig. 19).

Distribution and ecology

Moore (1972) mentions *T. grossus* of Hartz Mountain and Mt Field and Lune River (south of Hastings), recent data in our possession confirm this distribution (Map 6). At Lake Osborne *T. grossus* was collected by sieving litter in a small humid forest near the car park, while the discovery of a specimen in the Mystery Creek Cave is considered incidental.

Tasmanorites madidus Moore, 1972
(Fig. 17)

Loc. Typ.: Mt. Field, SE Tasmania
Tasmanorites madidus Moore, 1972: 17.
Tasmanorites madidus Moore: Casale & Laneyrie, 1982: 59.
Tasmanorites madidus Moore: Moore et al, 1987: 127.
Tasmanorites madidus Moore: Lorenz, 2005: 168.

Examined material

2 ♂♂ 1 ♀, Australia, Tas., Cradle Mts. N. P., Marion Lookout Track, m 1100, 25.XI.1999, P.M. Giachino leg. (CGi). 2 ♀♀, Australia, Tas., Gordon River Rd., Creepy Crawly Walk, m 565, 17.I.2002, P.M. Giachino leg. (CGi).

Notes

The original description by Moore (1972) is sufficiently accurate and does not need any additions, while we believe it is useful to supply a drawing of the habitus (Fig. 17).

Distribution and ecology

Moore (1972) mentions *T. madidus* of Mt. Field, Waldheim, and Lake St. Clair.; the new locality of Creepy Crawly Walk, situated along the Gordon River Rd., expands the known range slightly southwestwards (Map 6). In this new site *T. madidus* was collected by sieving rainforest litter.

Tasmanorites riparius Moore, 1972
(Figs 18, 20, 21)

Loc. Typ.: Waldheim, Tas.
Tasmanorites riparius Moore, 1972: 17.
Tasmanorites riparius Moore: Casale & Laneyrie, 1982: 59.
Tasmanorites riparius Moore: Moore et al, 1987: 128.
Tasmanorites riparius Moore: Lorenz, 2005: 168.

Examined material

2 ♂♂ 1 ♀, Australia, Tas., Murchison St. For., 30.I.2002, P. M. Giachino leg. (CGi).

Notes

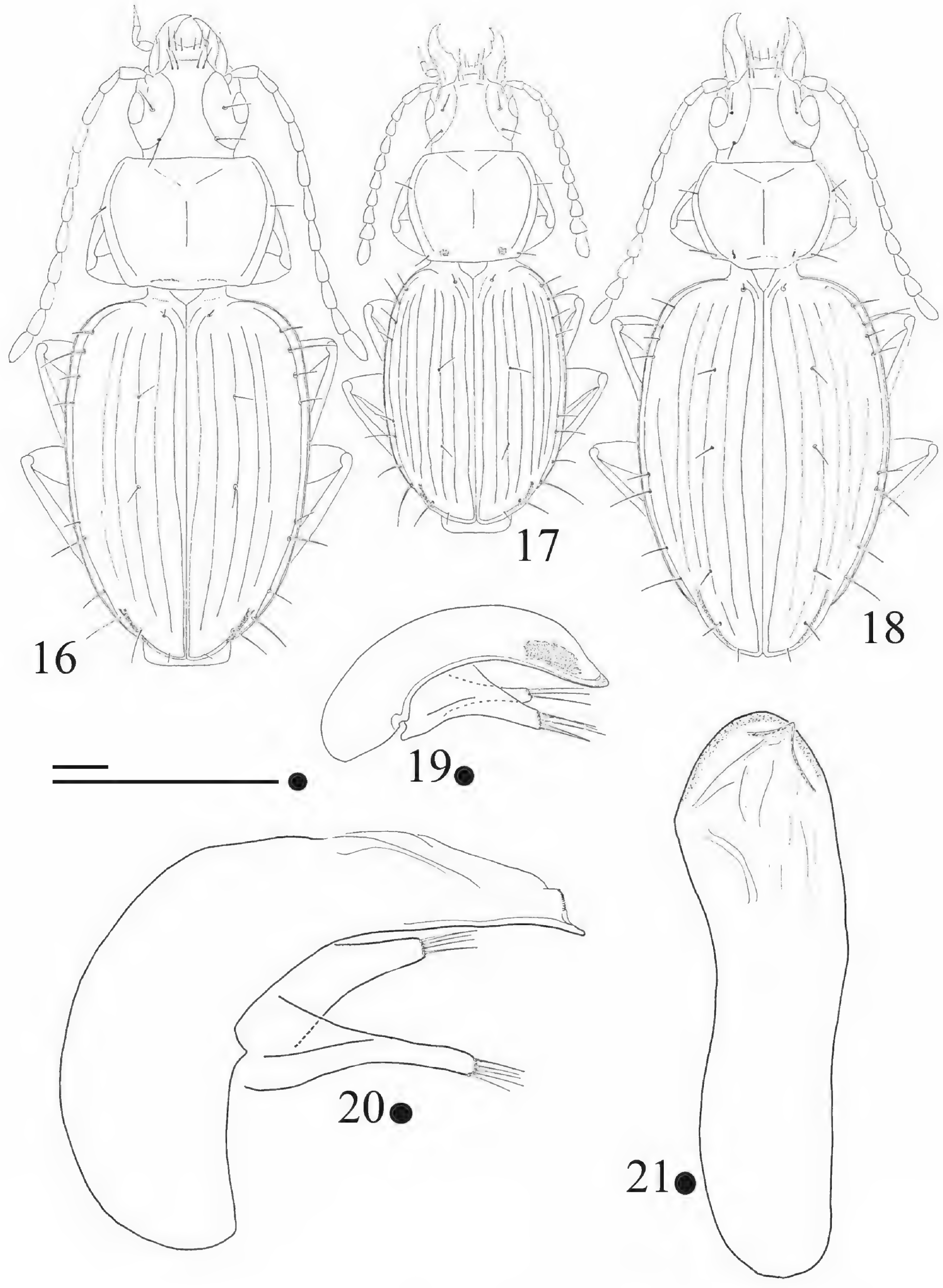
The original description is sufficiently accurate and requires no additions, while we believe it is useful to provide a drawing of the habitus (Fig. 18) and of the aedeagus (Figs 20, 21), the latter was not given by Moore (1972).

Distribution and ecology

Moore (1972) mentions *T. riparius* of Waldheim, Waratah, Corinna, and N of Zeehan; the new findings of Murchison State Forest, confirm the range of this species (Map 6). In this station *T. riparius* was collected sieving rain forest litter beside a small stream.

Tasmanorites brevinotatus (Sloane, 1920)
(Figs 22, 24)

Loc. Typ.: Great Lake
Trechus brevinotatus Sloane, 1920: 149.
Tasmanorites brevinotatus Sloane: Jeannel, 1927: 79.
Tasmanorites brevinotatus (Sloane): Moore, 1972: 17.
Tasmanorites brevinotatus (Sloane): Casale & Laneyrie, 1982: 59.



Figs 16-21. Habitus (16, 17, 18), aedeagus in lateral view (19, 20) and aedeagus in dorsal view (21) of *Tasmanorites* spp.: 16, 19) *T. grossus* Moore, ♂ from Lake Osborne; 17) *T. madidus* Moore, ♀ from Creepy Crawly Walk; 18, 20, 21) *T. riparius* Moore, ♂ from Murchison State Forest. Scale: 0.5 mm.

Tasmanorites brevinotatus (Sloane): Moore et al, 1987: 126.
Tasmanorites brevinotatus (Sloane): Donabauer, 2001: 103.
Tasmanorites brevinotatus (Sloane): Lorenz, 2005: 168.

Type material

HT ♂, Great Lake 3/91(white, handwritten and printed), Type (white, printed), *Trechus brevinotatus* Sl. Id. by T.S. Sloane (white, handwritten and printed), *Trechus brevinotatus* Tasmania S.10815, Type (white, handwritten with black and red writing), Holotype *T. brevinotatus* Sl. (red, handwritten) (SAM).

Notes

The original description by Sloane (1920) and subsequent additions by Jeannel (1927) and Moore (1972) are sufficiently accurate and do not require any additions, while we believe it is useful to provide the drawing of the habitus (Fig. 22) and of the aedeagus (Fig. 24), the latter had never been made before.

Distribution and ecology

T. brevinotatus is known from the type locality of Great Lake (Map 7). Moore (1972) also mentions Lake St. Clair on specimens collected from litter by the Darlingtons. This deserves further confirmation.

Tasmanorites beatricis sp. nov.
(Figs 23, 25)

Loc. Typ.: Tasmania, Cradle Mts National Park, Cradle Mts Lodge m 800.

Type series

HT ♂, Australia, Tas., Cradle Mts N.P., Cradle Mts Lodge m 800, 30.I.2002, P.M. Giachino leg. (QVML). PTT: 11 ♂♂ 8 ♀♀, Australia, Tas., Cradle Mts N.P., Cradle Mts Lodge m 800, 30.I.2002, P.M. Giachino leg. (CGi)

Diagnosis

A small-sized (mm 3.18-3.35) *Tasmanorites*, similar to *T. brevinotatus* for the shape of the body and of the aedeagus. It is well distinct for the size slightly smaller (3.70 mm in *T. brevinotatus*), for the less elongated elytra, for bigger elytral maculae (humeral and apical), and for the more rearward position of the third discal seta. From *T. brevinotatus* it also differs in the shape of the median lobe of the aedeagus, less elongated and less sharply bent at the level of the basal bulb, as well as in the apical blade that is not folded hookwise upwards.

Description

Length mm 3.18-3.20 ♂♂, 3.25-3.35 ♀♀. Body obovate (Fig. 23), with a small fore-body in comparison with the elytra, which are short and ovate. Dorsal surface glabrous and shiny, with an isodiametric microsculpture. Metathoracic wings absent. Colour blackish brown, with lateral margins of elytra and pronotum, elytral suture, epipleura, legs, first antennomere, and palpi testaceous-yellow; elytra with two testaceous-yellow humeral maculae extended to the first discal seta and two apical testaceous-yellow maculae laterally extended to the apical 4th. Head large. Clypeus convex at the base, with two apical setae on each side. Eyes big, convex but not prominent. Neck constriction evident. Labrum transverse, with a slightly emarginated apex; mandibles slender. Antennae short and slender, as long as the half of the body. Second antennal segment less long than the first one. Pronotum transverse (PW/PL: 1.37), widest at about 2/3 from the base. Base narrower than the anterior margin. Sides not sinuate and subrectilinear before the base, which is subrectilinear; hind angles obtuse, rounded and not projected outwards. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 2/3 from the base; basal seta present, inserted before the angles. Basal foveae smooth, lightly impressed, stretched. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra broad, oval, largest in the middle, slightly convex. Shoulders rounded, with the humeral border continuing inwards almost to the base of 3rd stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all the striae visible; juxtascutellar stria present; apical recurrent striole long, gently curved, ending at the level of the 6th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; three setiferous pores on the third stria, respectively, at the basal 5th, in the middle, and at the apical 5th. One preapical pore placed backwards and closer to the recurrent striole. Aedeagus (Fig. 25) small (length 0.65 mm), stout, with the basal bulb large; median lobe, in lateral view, curved in the basal third, from gently curved to subrectilinear in the distal 2/3; apex long, with the apical blade stout, subtruncate, and not bent upwards. Inner sac apically provided with a patch of sclerotized scales. Parameres long and stout, reaching the apical third of the median lobe, each one provided with 4 setae.

Etymology

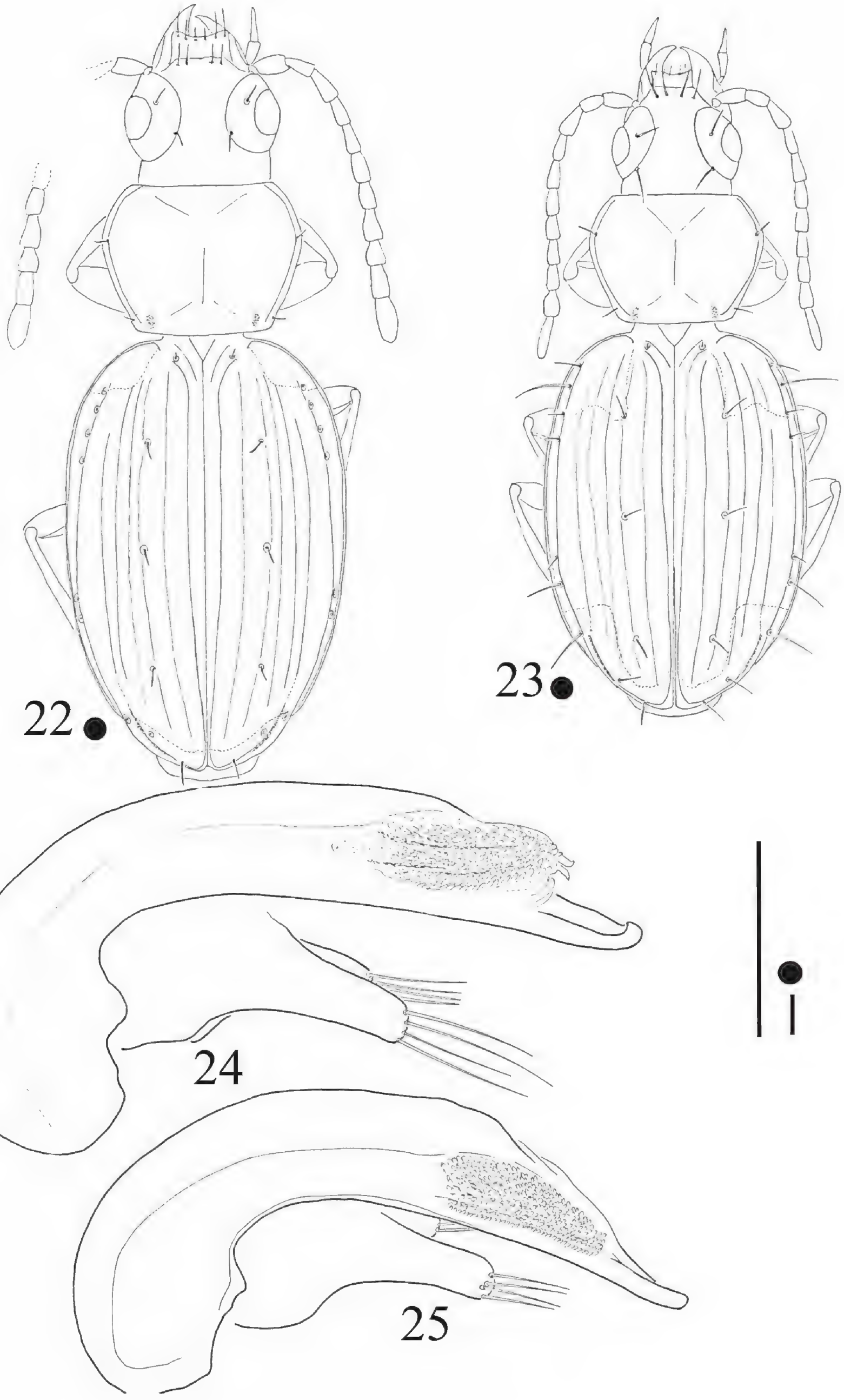
I dedicate this new species with pleasure and affection to Beatrice Sambugar, a research companion during the first trip to Tasmania of one of us (P.M.G.)

Distribution and ecology

T. beatricis sp. nov. is currently known only from the type locality of Cradle Mts Lodge in Cradle Mts National Park, where it was collected by sieving *Nothofagus* litter at a height of 800 m a.s.l. (Map 7).

Tasmanorites elegans Moore, 1972
(Fig. 26)

Loc. Typ.: St. Marys, in "Bottomless Pit", Gray Mountain, NE Tasmania.



Figs 22-25. Habitus (22, 23) and aedeagus in lateral view (24, 25) of *Tasmanorites* spp.: 22, 24) *T. brevinotatus* (Sloane), HT ♂ from Great Lake; 23, 25) *T. beatricis* sp. nov., HT ♂ from Cradle Mts. Scale: 0.2 mm.

Tasmanorites elegans Moore, 1972: 18.
Tasmanorites elegans Moore: Casale & Laneyrie, 1982: 59.
Tasmanorites elegans Moore: Moore et al, 1987: 126.
Tasmanorites elegans Moore: Lorenz, 2005: 168.

Examined material

2 ♀♀ and 1 spec. (remains: elytra and abdomen without genitalia), Tas., 41°37'S 148°12'E, G-X2 – 10 Gray, Elephant Fram Cave, dark zone, 11.VIII.1988, S. Eberhard leg., QVM 12: 43785 (QVML, CGi);

Notes

The original description is sufficiently accurate and requires no additions, while we believe it is useful to provide a drawing of the habitus (Fig. 26), that was not given by Moore (1972).

Distribution and ecology

T. elegans is currently known from two sites, both caves, near Gray (NE Tasmania): Bottomless Pit and Elephant Fram Cave (Map 7). The species is not obviously troglomorphic and is considered a troglophile.

Tasmanorites longinotatus (Sloane 1920)

Loc. Typ.: Mt. Ben Lomond
Trechus longinotatus Sloane, 1920: 148
Tasmanorites longinotatus Sloane: Jeannel, 1927: 78.
Tasmanorites longinotatus Sloane: Moore, 1972: 18.
Tasmanorites longinotatus Sloane: Casale & Laneyrie, 1982: 59.
Tasmanorites longinotatus Sloane: Moore et al, 1987: 126.
Tasmanorites longinotatus Sloane: Lorenz, 2005: 168.

Examined material

1 ♂ 3 ♀♀, Australia, Tas., Ben Lomond N. P., Hamilton Crags, Meadow Vale, m 1400, 30.XI.1999, P.M. Giachino (CGi).

Distribution and ecology

T. longinotatus is currently known from three localities in the mountains of Ben Lomond and Mt Barrow in NE Tasmania (Moore, 1972) (Map 7).

Tasmanorites aberrans Moore, 1972
(Figs 27, 30)

Loc. Typ.: King River (between Lake St. Clair and Queenstown), central Tasmania.
Tasmanorites aberrans Moore, 1972: 21.
Tasmanorites aberrans Moore: Casale & Laneyrie, 1982: 59.
Tasmanorites aberrans Moore: Moore et al, 1987: 126.
Tasmanorites aberrans Moore: Lorenz, 2005: 168.

Examined material

9 ♂♂ 1 ♀, Australia, Tas., Strahan, Kelly Cove, Pillinger, 26.I.2002, P. M. Giachino leg. (CGi); 1 ♀, Australia, Tas., Strahan, Franklin-Gordon Wild River N.P., Gordon River, Heritage Landing Walk, 25.I.2002, P. M. Giachino leg. (CGi); 3 ♂♂ 3 ♀♀, Lake St. Clair, Tas., Jan 1941, C. Oke (MVM, CGi); 2 ♂♂, Mt. Wellington? (MVM);

Notes

The original description is sufficiently accurate and requires no additions, while we believe it is useful to provide a drawing of the habitus (Fig. 27) and of the aedeagus (Fig. 30), that had not been made by Moore (1972).

Distribution and ecology

Moore (1972) described *T. aberrans* from King River, south of Queenstown, which has remained until now the only known locality of the species. Recent data from Pillinger (Kelly Cove, near Strahan) and Heritage Landing Walk (Gordon River, near Strahan) are relatively close to the type locality, while the collection site of Lake St. Clair, on old specimens collected by C. Oke in 1941, significantly extends the range of this species to the east (Map 6). Doubtful, and very far geographically, is the collection site of Mt Wellington, lacking among other details the collector's name. In the original description, Moore (1972) mentions the species collected in "long grass beside a shallow pool"; the specimens collected by one of us (PMG) near Strahan were collected by sieving rain forest litter along bank of the Gordon River.

Tasmanorites austrinus (Sloane 1920)
(Figs 28, 31)

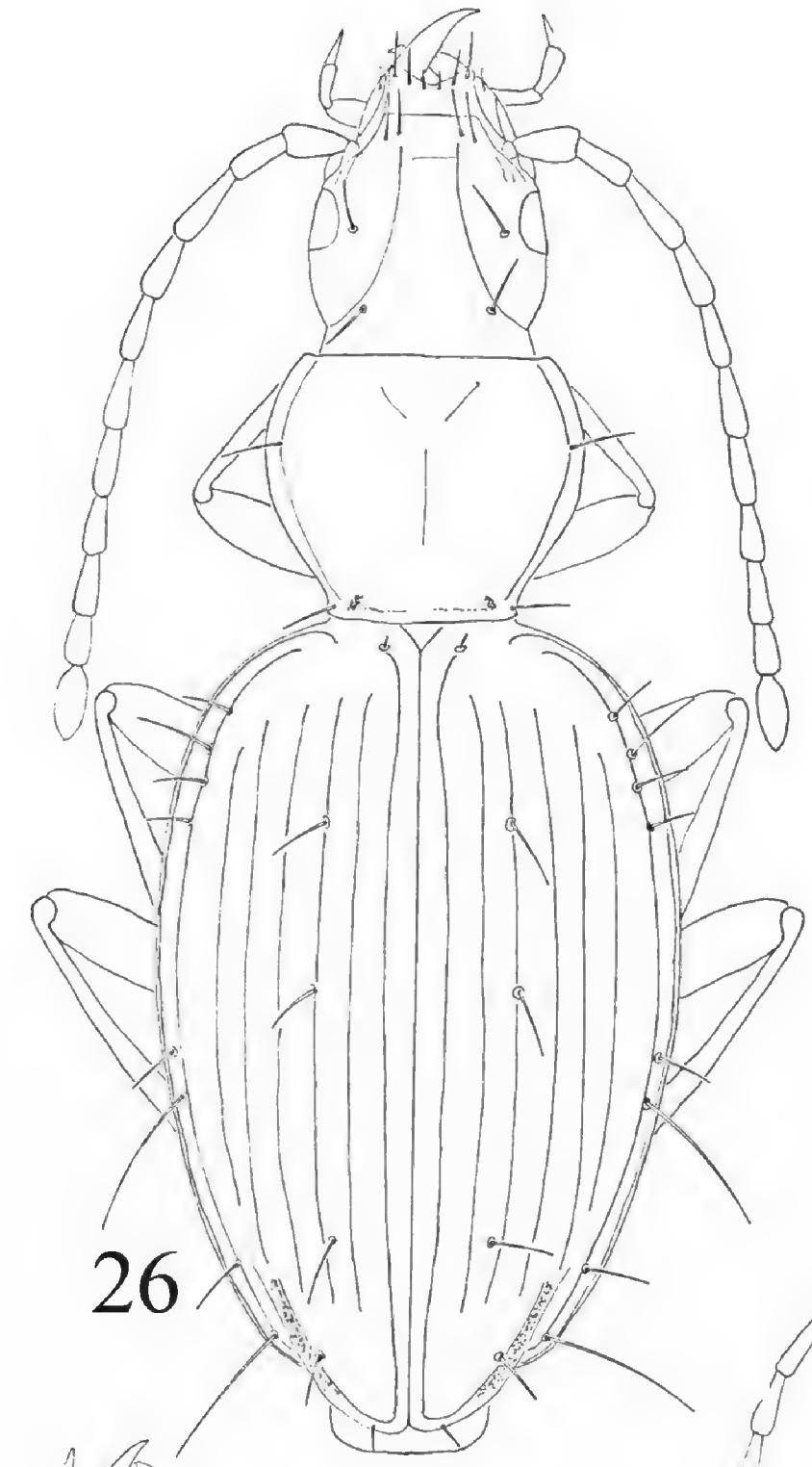
Loc. Typ.: Great Lake
Trechus austrinus Sloane, 1920: 147.
Sloanella austrina Sloane: Jeannel, 1927: 88.
Tasmanorites austrinus (Sloane): Moore, 1972: 21.
Tasmanorites austrinus (Sloane): Casale & Laneyrie, 1982: 59.
Tasmanorites austrinus (Sloane): Moore et al, 1987: 126.
Tasmanorites austrinus (Sloane): Lorenz, 2005: 168.

Type material

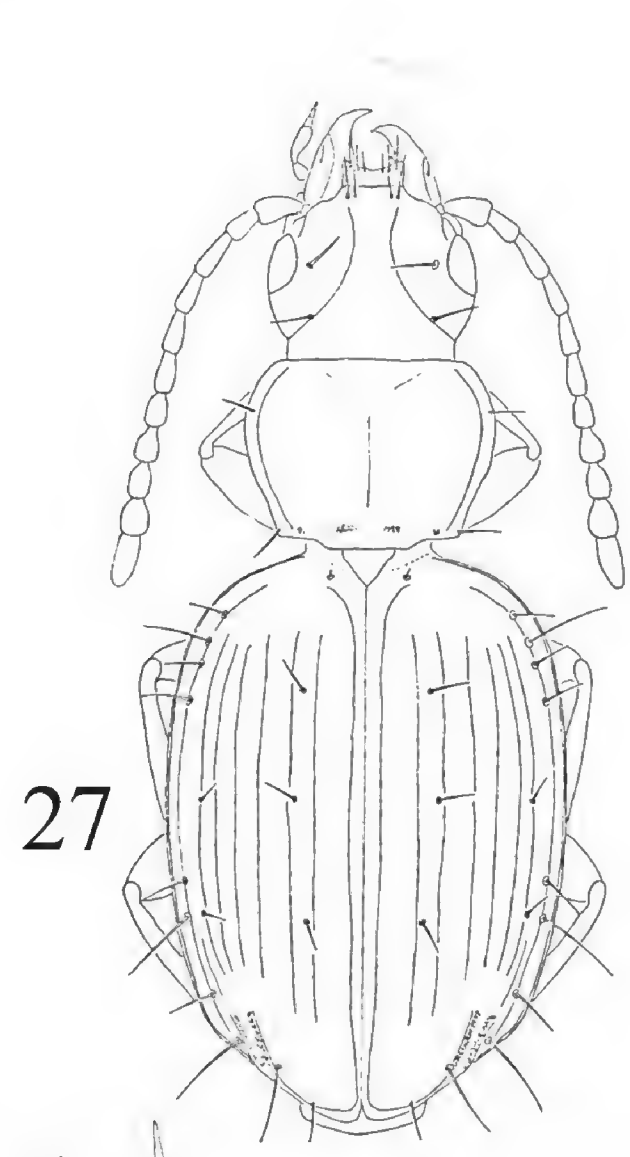
HT ♂, Great Lake 3/91, (white, printed), *Trechus austrinus* Sl. Id. by T.S. Sloane (white, handwritten and printed), Type (white, printed), Trechus austrinus Sl. Tasmania S. 10813 Type (white, handritten with black and red writing), Holotype *T. austrinus* Sl. PID (red, handwritten) SAM.

Examined material

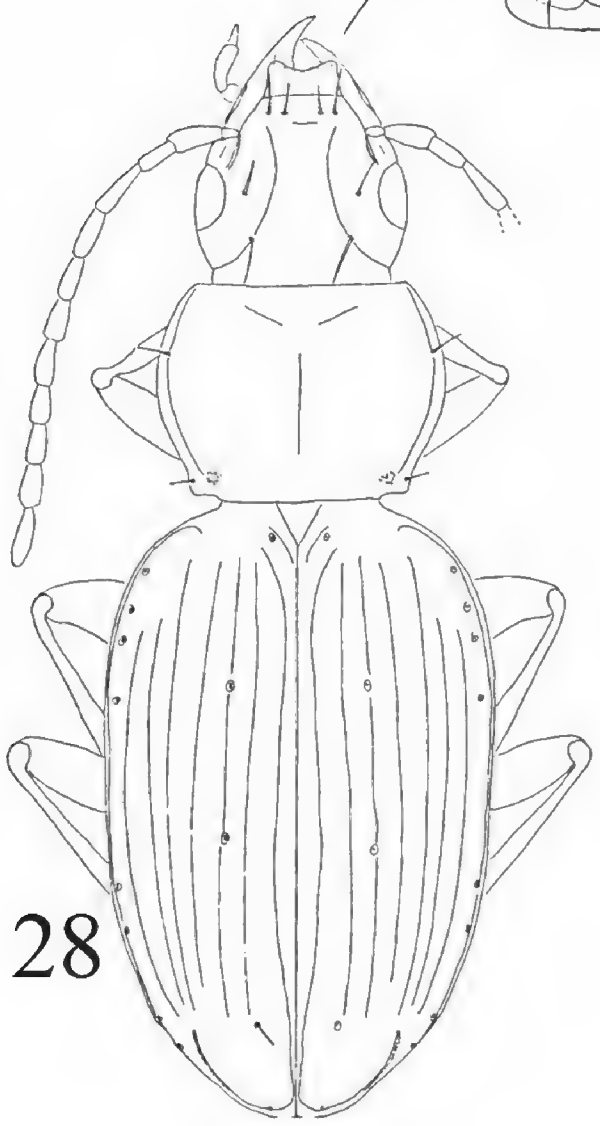
1 ♀, Australia, Tas., Lake St. Clair N.P. m 740, rainforest sieved litter, 23.I.2002, P.M. Giachino leg. (CGi).



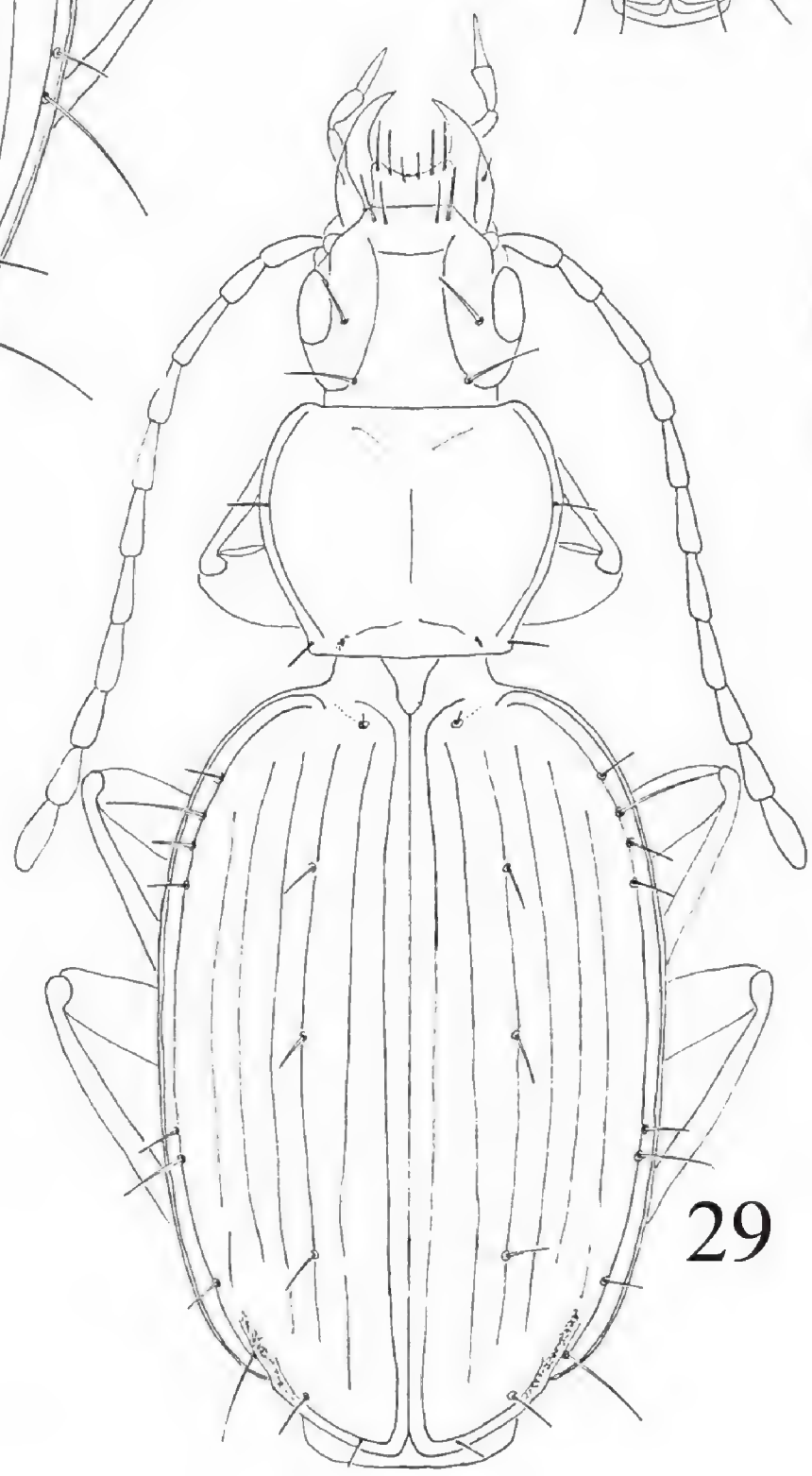
26



27



28



29

Figs 26-29. Habitus of *Tasmanorites* spp.: 26) *T. elegans* Moore, ♀ from Elephant Fram Cave; 27) *T. aberrans* Moore, ♂ from Pillinger, Kelly Cove; 28) *T. austrinus* (Sloane), HT ♂ from Great Lake; 29) *T. magnus* Moore, ♂ from Ben Lomond. Scale: 1 mm.

Notes

The original description by Sloane (1920) and subsequent additions by Jeannel (1927) and Moore (1972) are sufficiently accurate and need no further additions, but we believe it is useful to provide a drawing of the habitus (Fig. 28) and of the aedeagus (Fig. 31) of the holotypus.

Distribution and ecology

Sloane (1920) describes *T. austrinus* from Great Lake, while Moore (1972) mentions it also from Lake St. Clair on collections of Darlington. The specimen collected by one of us (PMG) near Lake St. Clair (by sieving rainforest litter), compared with holotypus deposited in the SAM, confirmed the accuracy of Moore's additions (1972) (Map 6).

Tasmanorites magnus Moore, 1972
(Figs 29, 32)

Loc. Typ.: Mt. Ben Lomond (3000-4000 ft), NE Tasmania.

Tasmanorites magnus Moore, 1972: 22.
Tasmanorites magnus Moore: Casale & Laneyrie, 1982: 59.
Tasmanorites magnus Moore: Moore et al, 1987: 127.
Tasmanorites magnus Moore: Lorenz, 2005: 168.

Examined material

16 ♂♂ 12 ♀♀, Australia, Tas., Ben Lomond N. P., Hamilton Crags, Meadow Vale, m 1400, 30.XI.1999, P.M. Giachino (MRSN, CGi); 6 ♂♂ 3 ♀♀, Australia, Tas., Ben Lomond N. P., Legger Tor m 1530, 14.I.2002, P.M. Giachino leg. (CGi); 23 ♂♂ 15 ♀♀, Australia, Tas., Ben Lomond N. P., Hamilton Crags, Meadow Vale m 1450, 13-14.I.2002, P.M. Giachino leg. (CGi)

Notes

The original description is sufficiently accurate and requires no additions, while we believe it is useful to provide a drawing of the habitus, that had not been given by Moore (1972) (Fig. 29) and of the aedeagus (Fig. 32).

Distribution and ecology

T. magnus is currently known from the type locality of Ben Lomond and Mt Barrow nearby (Map 7). At Ben Lomond it was collected by one of the authors (PMG) under stones along the streams of the plateau near the Ski Resort.

Tasmanorites nitens (Putzeys, 1874)
(Figs 33, 35)

Loc. Typ.: Tasmania.

Trechus nitens Putzeys, 1874: 50.
Tasmanorites nitens Putzeys: Jeannel, 1927: 75.
Tasmanorites nitens (Putzeys): Moore, 1972: 22.
Tasmanorites nitens (Putzeys): Casale & Laneyrie, 1982: 59.
Tasmanorites nitens (Putzeys): Moore et al, 1987: 127.
Tasmanorites nitens (Putzeys): Donabauer, 2001: 103.
Tasmanorites nitens (Putzeys): Lorenz, 2005: 168.

Type material

LT ♂, Tasmania, Coll. Castelnau (white, handwritten); Mus. de Genes (white, handwritten); *Trechus nitens* Putz., R. Jeannel det. (white, handwritten and printed); Syntypus, *Trechus nitens* Putzeys, 1874 (red, handwritten and printed); Lectotypus ♂, *Trechus nitens* Putzeys, P.M. Giachino det. 2009 (MCSNG). PLT ♀, Tasmania, Coll. Castelnau (white, handwritten and printed); Tasmania (white, handwritten); Syntypus, *Trechus nitens* Putzeys, 1874 (red, handwritten and printed); *Trechus nitens* Putz. t. Putz. (white, handwritten); *Trechus nitens* Putz., R. Jeannel det. (white, handwritten and printed); Paralectotypus ♀, *Trechus nitens* Putzeys, P.M. Giachino det. 2009 (MCSNG). PLTT 2 ♀♀, Tasmania (white, handwritten); Tasmania, Coll. Castelnau (white, handwritten and printed); Syntypus, *Trechus nitens* Putzeys, 1874 (red, handwritten and printed); *Trechus nitens* Putz., R. Jeannel det. (white, handwritten and printed); Paralectotypus ♀, *Trechus nitens* Putzeys, P.M. Giachino det. 2009 (MCSNG).

Examined material

1 ♂, Tas. Summit of Mt. Wellington, Lea (SAM).

Notes

In order to ascertain the validity of *T. lynceorum* sp. nov., described below, it was necessary to examine the type series of *T. nitens* deposited in the MCSNG, and to designate the Lectotype. The description by Jeannel (1927), who had the chance to examine the type material is sufficiently accurate and requires no further additions, but again we believe it is useful to provide a drawing of the habitus (Fig. 33) and of the aedeagus (Fig. 35) of the holotype.

Distribution and ecology

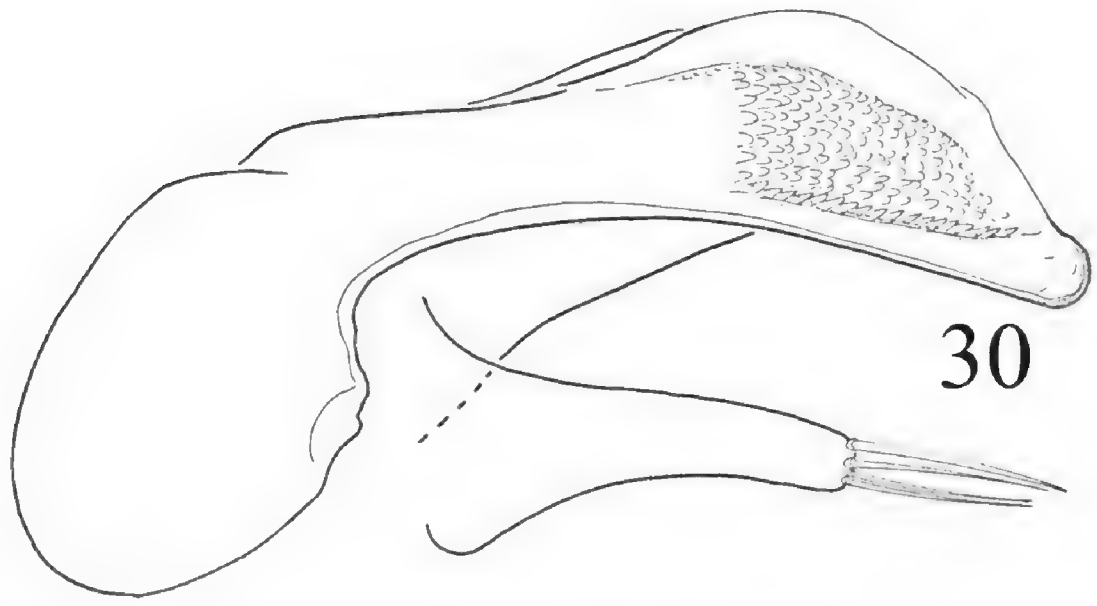
T. nitens is currently known only from the type locality of Mt Wellington where it is present, among the roots of grasses, above the tree line (Moore 1972) (Map 7). But in this environment, one of the authors (PMG) has found, in January, the closely related *T. lynceorum* sp. nov., described below.

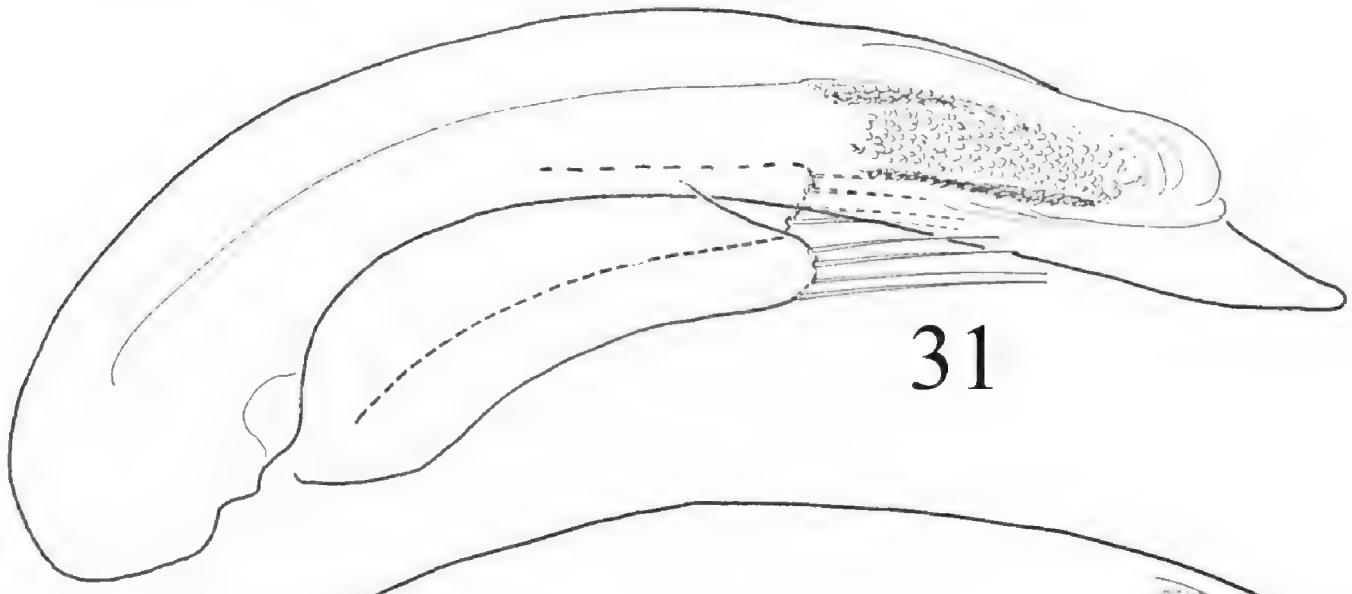
Tasmanorites lynceorum sp. nov.
(Figs 34, 36)

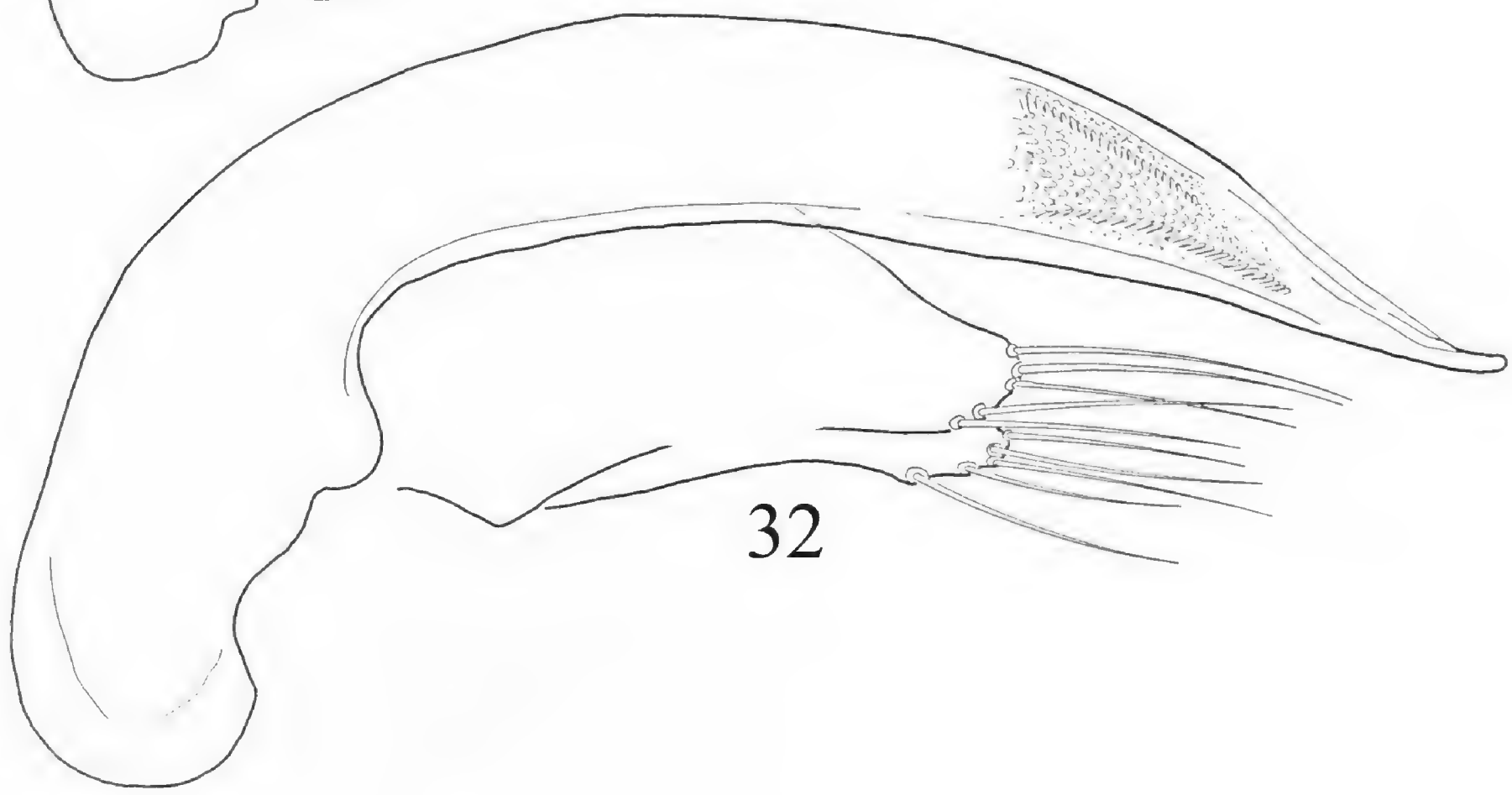
Loc. Typ.: Tasmania, Hobart, Mt. Wellington, m 1200

Type series

HT ♂, Australia, Tas., Hobart, Mt. Wellington, m 1200, 19.I.2002, P.M. Giachino leg. (QVML). PTT: 6 ♀♀, Australia, Tas., Hobart, Mt. Wellington, m 1200, 19.I.2002, P.M. Giachino leg. (CGi); 6 ♂♂ 7 ♀♀, Australia, Tas., Hobart, Mt. Wellington, m 1270 27.XI.1999, P.M. Giachino leg. (MRSN, MVM, CGi).







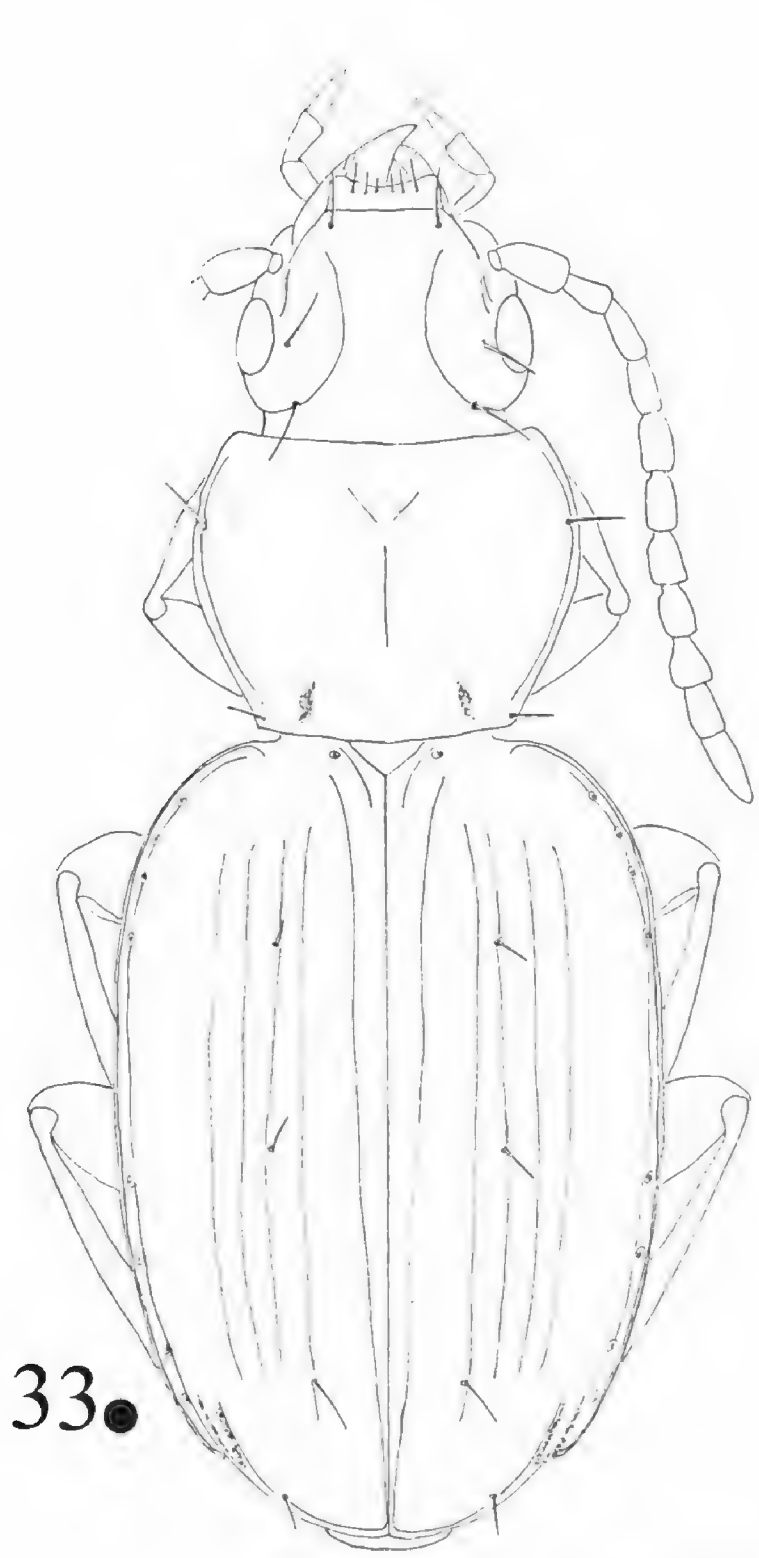
Figs 30-32. Aedeagus in lateral view of *Tasmanorites* spp.: 30) *T. aberrans* Moore, ♂ from Pillinger, Kelly Cove; 31) *T. austrinus* (Sloane), HT ♂ from Great Lake; 32) *T. magnus* Moore, ♂ from Ben Lomond. Scale: 0.1 mm.

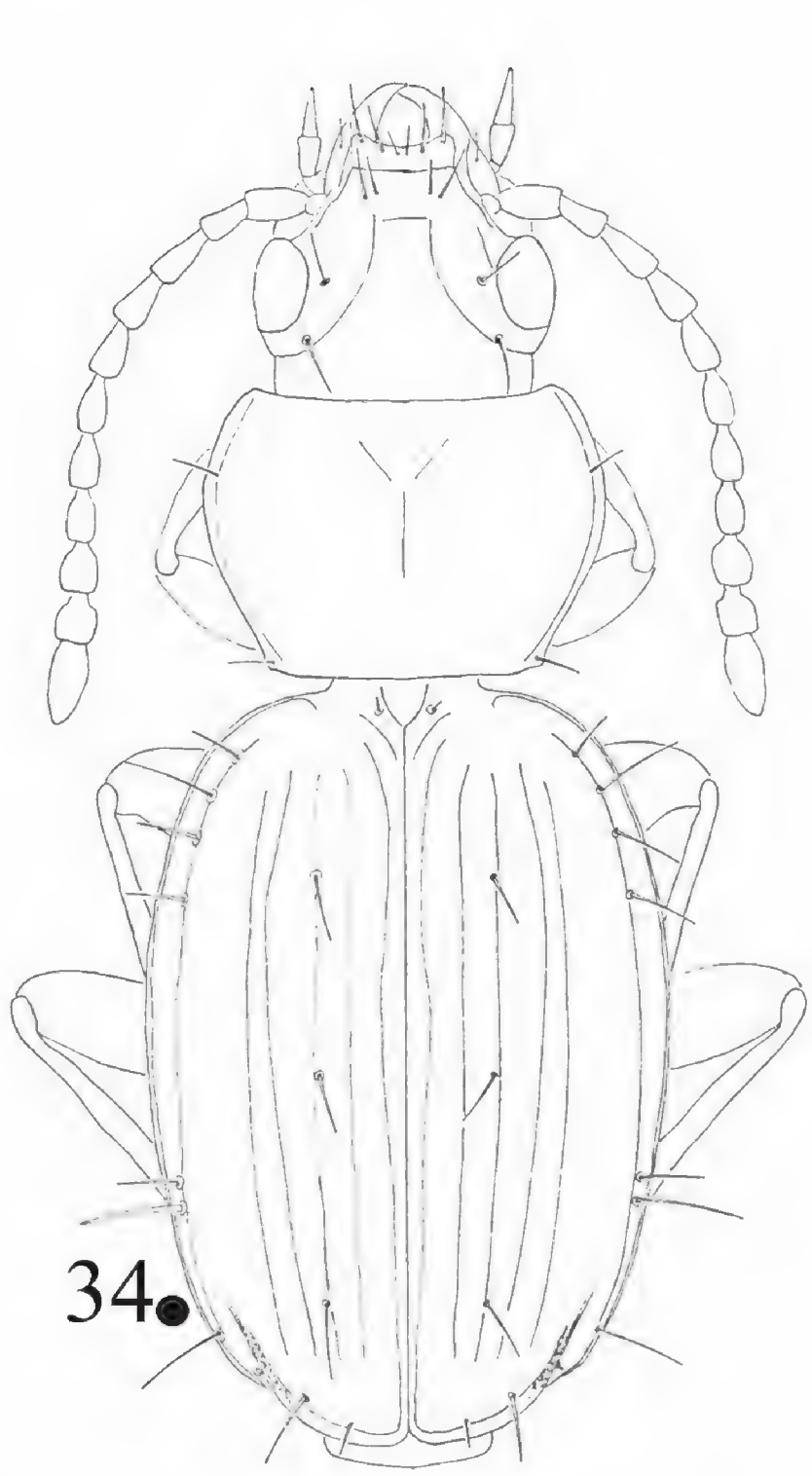
Diagnosis

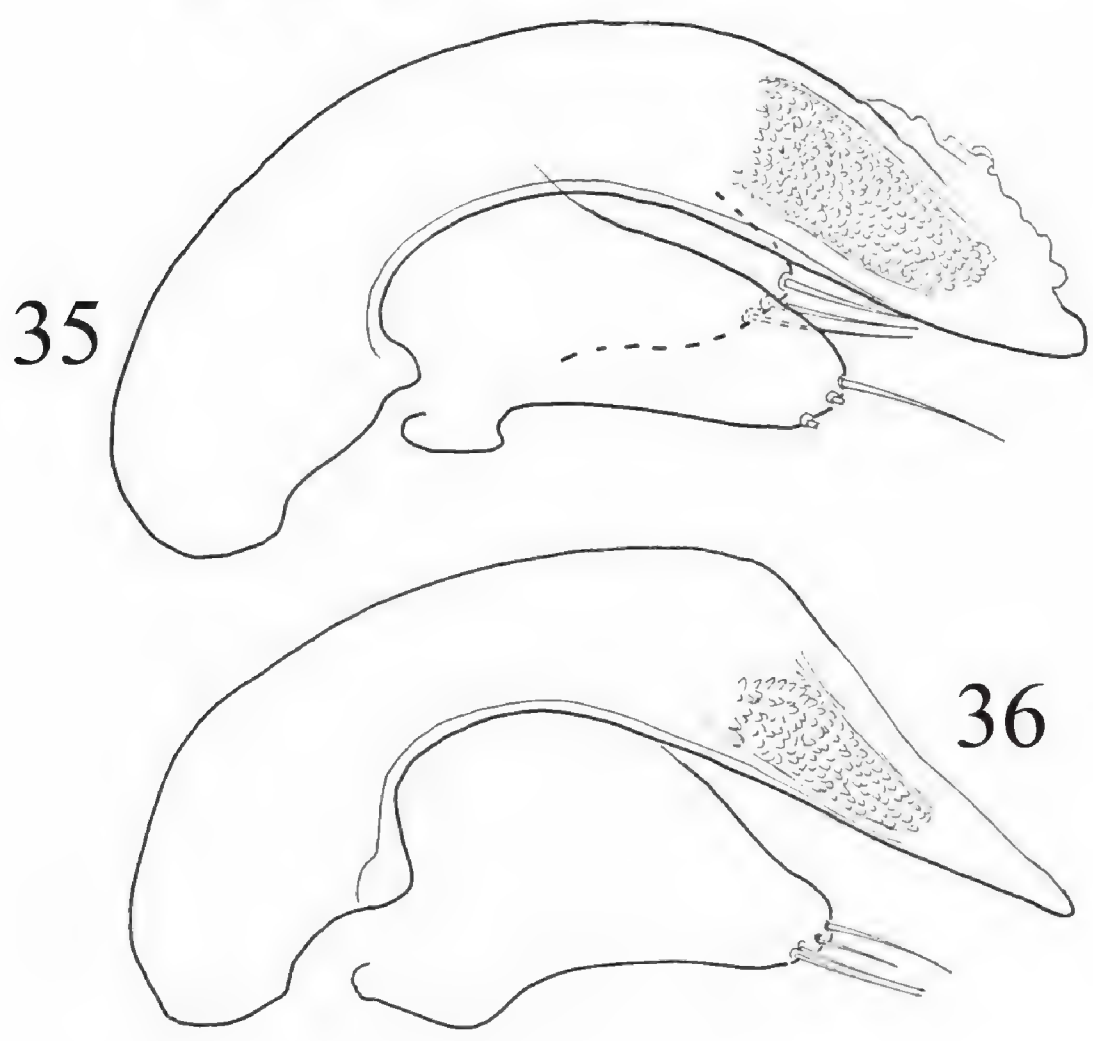
A small-sized (mm 3.16-3.30) *Tasmanorites*, similar to *T. nitens* for the general shape of the body and of the aedeagus. Well separated from it for the pronotum more transverse, the antennae shorter, the eyes bigger and the shape of the median lobe of the aedeagus, in lateral view, with an acute apex (Figs 35, 36).

Description

Length mm 3.16-♂, 3.21-3.30 ♀♀. Body obovate (Fig. 34), with a relatively large fore-body in comparison with the elytra, which are short and ovate. Dorsal surface glabrous and shiny, with the microsculpture isodiametric on the pronotum, as transverse meshes on the elytra. Metathoracic wings absent. Colour blackish brown, with legs,







Figs 33-36. Habitus (33, 34) and aedeagus in lateral view (35, 36) of *Tasmanorites* spp.: 33, 35) *T. nitens* (Putzeys), LT ♂ from Tasmania; 34, 36) *T. lynceorum* sp. nov., HT ♂ from Mt. Wellington. Scale: 0.5 mm.

antennomeres, and palpi testaceous. Head large. Clypeus convex at the base, with two apical setae on each side. Eyes large, convex but not prominent. Neck constriction evident. Labrum transverse, with an emarginated apex; mandibles stout. Antennae short and slender, as long as the half of the body. Second antennal segment less long than the first one. Pronotum transverse (PW/PL: 1.44), widest at about 2/3 from the base. Base narrower than the anterior margin. Sides slightly sinuate before the base, which is subrectilinear; hind angles obtuse, edged and slightly turned out. Front angles rounded and slightly advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 2/3 from the base; basal seta present, inserted at the angles. Basal foveae smooth, slightly impressed, stretched. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra broad, oval, largest in the middle, slightly convex. Shoulders rounded, with the humeral border continuing inwards almost to the base of 3rd stria. Lateral border of elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with 1st – 5rd striae visible, the others obsolete; juxtascutellar stria present; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; three setiferous pores on the third stria, respectively, at the basal 4th, in the middle, and at the apical 5th. One preapical pore placed backwards and closer to the recurrent striole. Aedeagus (Fig. 36) small (length 0.47 mm), slender, with the basal bulb large; median lobe, in lateral view, curved in the basal third, subrectilinear in the distal half; apex long, with the apical blade triangular and not bent upwards. Inner sac apically provided with a patch of sclerotized scales. Parameres long and very stout, reaching the apical fourth of the median lobe, each one provided with 4 setae.

Etymology

The name of this new species comes from the Accademia Nazionale dei Lincei in Rome, Italy, to which it is dedicated respectfully as a token of acknowledgement for the interest and the support that studies of one of the authors on the Australian fauna were gratified with.

Distribution and ecology

T. lynceorum sp. nov. is currently known only from the type locality of Mt. Wellington, near Hobart, where it was collected by sieving litter beneath bushes close to the top, above the tree line, at an elevation of 1200 m a.s.l. (Map 7).

Tasmanorites flavipes (Lea 1910)
(Figs 37, 38)

Loc. Typ.: Ida Bay Caves, Tas.
Idacarabus flavipes Lea, 1910: 56.
Tasmanorites flavipes (Lea): Moore, 1972: 22.
Tasmanorites flavipes (Lea): Casale & Laneyrie, 1982: 59.
Tasmanorites flavipes (Lea): Moore et al, 1987: 126
Tasmanorites flavipes (Lea): Lorenz, 2005: 168.

Type material

HT (very largely destroyed), flavipes Lea Type, Ida Bay Caves (white, handwritten and printed); Type (red printed); Idacarabus flavipes Lea, Type, Ida Bay Caves, 14123 (white, handwritten with black and red writing) (SAM).

Examined material

1 ♂, Tas., 42°42'S 146°35'E, JF4-26, Junee-Florentine, Khazad Dûm, near entrance in streamway, 27.VI.1989, Jean Jackson leg., QVM 12: 43788 (QVML); 1 ♀, Tas., 42°42'S 146°35'E, JF4-26, Junee-Florentine, Khazad Dûm, near entrance in streamway, 27.VI.1989, Jean Jackson leg. (CGi); 1 ♀, Tas., 42°40'S 146°27'E, Junee-Florentine Windy Rift, Growling Swallet Cave, Glow worm chamber, JF36-7, 26.III.1989, S. Eberhard leg., QVM 12: 43787 (QVML); 1 ♀, Tas., 42°40'S 146°27'E, Junee-Florentine Windy Rift, Growling Swallet Cave, Glow worm chamber, JF36-16, 6.II.1985, S. Eberhard leg. (CGi).

Notes

As pointed out by Moore (1972) the type of *T. flavipes* deposited at SAM is largely destroyed by dermestids and we believe it is useful to provide a drawing of the habitus (Fig. 37) and of the aedeagus (Fig. 38) of the ♂ specimen examined by us.

Distribution and ecology

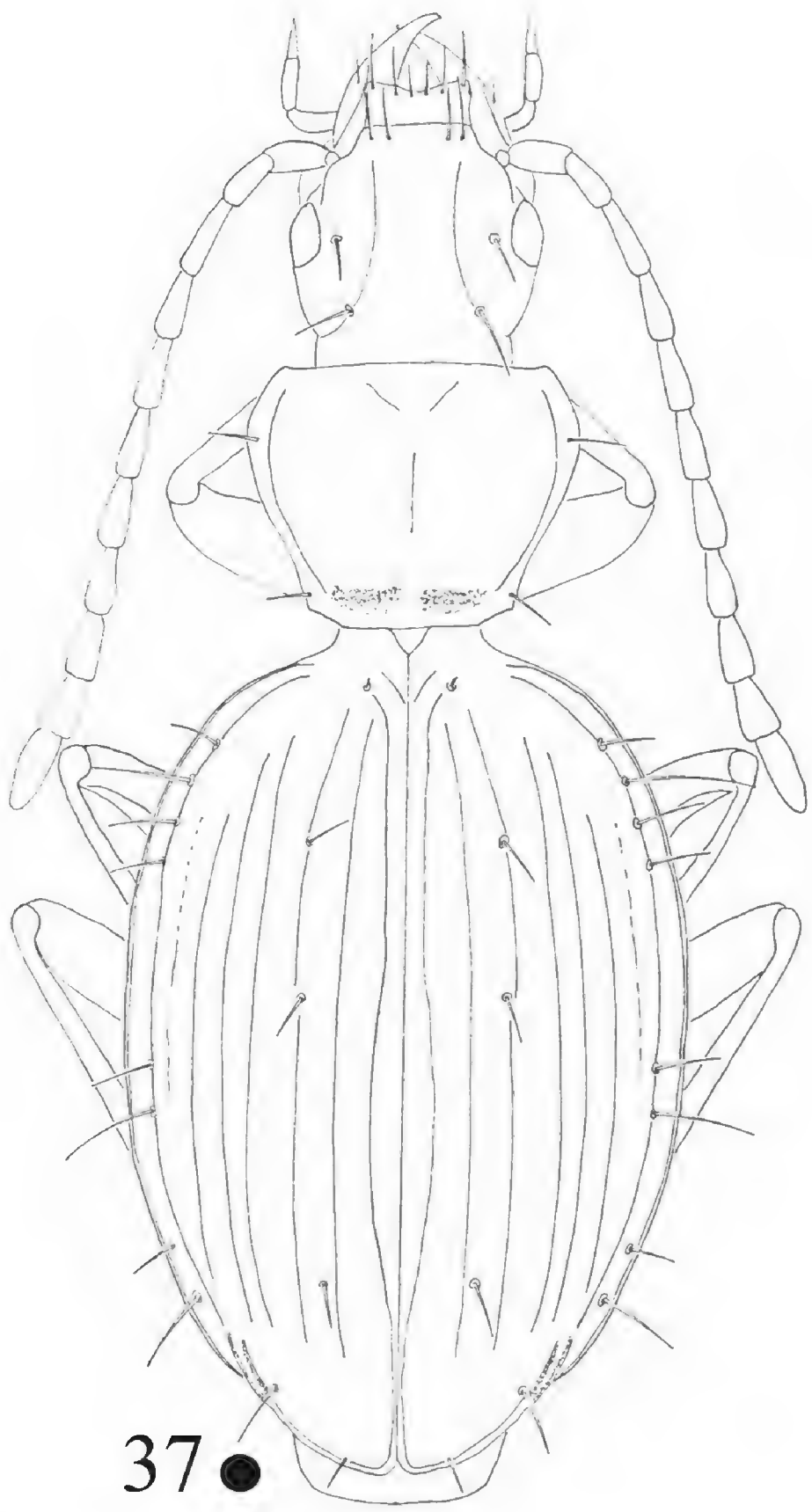
According with Moore (1972) and Moore et al (1987) *T. flavipes* is a hygrophilous species currently known from Ida Bay Caves, Arve River and Florentine Valley (Map 6).

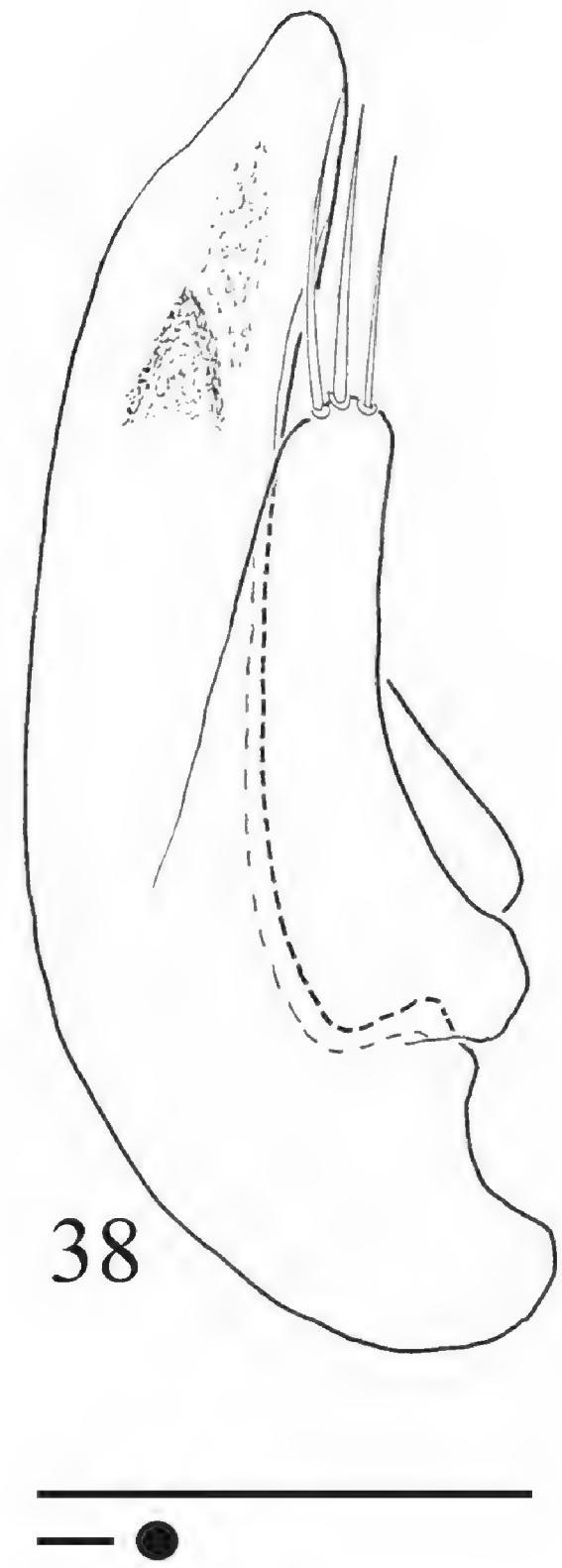
Tasmanorites tasmaniae (Blackburn 1901)
(Figs 39, 44-46)

Loc. Typ.: Lake district, Tas.
Trechus tasmaniae Blackburn, 1901: 118.
Trechus tasmaniae Blackburn: Sloane, 1920: 150.
Tasmanorites tasmaniae Blackburn: Jeannel, 1927: 76.
Tasmanorites tasmaniae (Blackburn): Moore, 1972: 22.
Tasmanorites tasmaniae (Blackburn): Casale & Laneyrie, 1982: 59.
Tasmanorites tasmaniae (Blackburn): Moore et al, 1987: 127.
Tasmanorites tasmaniae (Blackburn): Lorenz, 2005: 168.

Type material

T ♂, 6956 T T.J.S. 4 a Yes (near indecipherable) (red and black handwriting on the card holding the insect), Type (circular, printed with a red margin), Blackburn coll. 1910-236 (white, printed), *Trechus tasmaniae* Blackb. (BMNH). CT ♂, *Trechus tasmaniae* Bl., Tasma-





Figs 37-38. Habitus (37) and aedeagus in lateral view (38) of *Tasmanorites flavipes* (Lea), ♂ from Khazad Dûm cave, Junee-Florentine. Scale: 0.2 mm.

nia, g-7729 Cotype (white, handritten with black and red writing), *Trechus Tasmaniae* Blackb., Co-type (white, handwritten) (SAM).

Notes

Moore (1972) mentions *T. tasmaniae* from central Tasmania: Lake District (type locality) and Mt Field, but he provides - probably misled by the illustrations given by Jeannel (1927: 76) and illustrating habitus and aedeagus of a specimen coming from Cradle Mts. (and therefore actually a specimen of *T. daccordii* sp. nov., described below) - a drawing of aedeagus and pronotum that do not correspond to the drawings derived from the specimens of the type series deposited in the BMNH and SAM (Figs 44-46). Conversely they seem to adapt well to the drawings (very schematic) proposed by Moore (1972) for *T. pullus* Moore, 1972. However the drawings of the aedeagi of the two subspecies of *T. pullus* provided by Donabauer (2001) allow the exclusion of the synonymy between *T. tasmaniae* and *T. pullus* s.l. We consider it useful to provide a brief diagnosis and drawings of habitus (Fig. 39) and aedeagus (Figs 44-46) of *T. tasmaniae*.

Diagnosis

A small-sized (mm 3.15-3.20) *Tasmanorites*, with the body oval elongated of a blackish colour, with palpi and tibia blackish brown, antennae blackish. Similar, in the shape of the body, and particularly of pronotum and elytra, to *T. daccordii* sp. nov., but well separated from this species by the pronotum narrower at the base, the elytra more elongated (Figs 39, 40), and the shape of the median lobe of the aedeagus more elongated and with the apex acute in lateral view and truncate in dorsal view (Figs 44-48).

Distribution and ecology

Contrary to the assertion by Sloane (1920), Jeannel (1927), Moore (1972), Moore et al (1987), and Donabauer (2001) mentioning *T. tasmaniae* also from Cradle Mts. and/or Mt Field, the only certain locality of this species is the typical one of the Lake district, unfortunately not better specified in the original description by Blackburn (1901) (Map 7)

Tasmanorites daccordii sp. nov.
(Figs 40, 47, 48)

Loc. Typ.: Tasmania, Cradle Mts National Park, Cradle Plateau m 1250.

Type series

HT ♂, Australia, Tas., Cradle Mts. N.P., Cradle Plateau m 1250, 31.I.2002, P. M. Giachino leg. (QVML). PTT: 5 ♂♂ 3 ♀♀, Australia, Tas., Cradle Mts. N.P., Cradle Plateau m 1250, 31.I.2002, P. M. Giachino leg. (CGi).

Diagnosis

A small-sized (mm 3.20-3.32) *Tasmanorites*, with an oval elongated body of a dark testaceous color. Similar in the shape of the body, particularly of pronotum and elytra, to *T. tasmaniae*. Well separated from this by the pronotum being less restricted at the base, the elytra less elongated (Figs 39, 40), and the shape of the median lobe of the aedeagus being less elongated and with the apex rounded in lateral view and not truncated in dorsal view (Figs 44-48).

Description

Length mm 3.20-3.25 ♂♂, 3.23-3.32 ♀♀. Body obovate (Fig. 40), with a relatively large fore-body in comparison with the elytra, which are short and ovate. Dorsal surface glabrous and shiny, with the microsculpture isodiametric on the pronotum, as transverse meshes on the elytra. Metathoracic wings absent. Colour blackish testaceous, with legs, antennomeres, and palpi testaceous. Head large. Clypeus convex at the base, with two apical setae on each side. Eyes large, convex but not prominent. Neck constriction evident. Labrum transverse, with a slightly emarginated apex; mandibles slender. Antennae short and slender, as long as a half of the body. Second antennal segment shorter than the first one. Pronotum transverse (PW/PL: 1.21), widest almost in the middle. Base narrower than the anterior margin. Sides slightly curved before the base, which is subrectilinear; hind angles obtuse, broadly rounded and not turned out. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 3/5 from the base; basal seta present, inserted before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra broad, oval, largest in the middle, slightly convex. Shoulders rounded, with the humeral border continuing inwards almost to the base of the 2nd-3rd stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with 1st – 5rd striae visible, the others obsolete; juxtascutellar stria present; apical recurrent striole long, gently curved, ending at the level of the 6th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; three setiferous pores on the third stria, respectively, at the basal 4th, in the middle, and at the apical 4th. One preapical pore placed backwards and closer to the recurrent striole. Aedeagus (Figs 47, 48) small (length 0.51 mm), slender, with the basal bulb large; median lobe, in lateral view, curved in the basal 4th, from gently curved to subrectilinear in the distal half; apex short, stout, rounded with the apical blade very reduced and, in dorsal view, subtriangular. Inner sac apically provided with a patch of sclerotized scales. Parameres long and moderately stout, reaching the apical 3rd of the median lobe, each one provided with 4 setae.

Etymology

We dedicate this new species with pleasure to Dr. Mauro Daccordi, a research companion of one of us (PMG) in Tasmania.

Distribution and ecology

T. daccordii sp. nov. is currently known only from the type locality of Cradle Plateau in Cradle Mts., where it was collected by sieving litter beneath *Nothofagus* bushes above the tree line, at an altitude of 1,250 m a.s.l. (Map 7). In this locality *T. daccordii* sp. nov. was collected in syntopy with *Tasmanotrechus alticola* sp. nov.

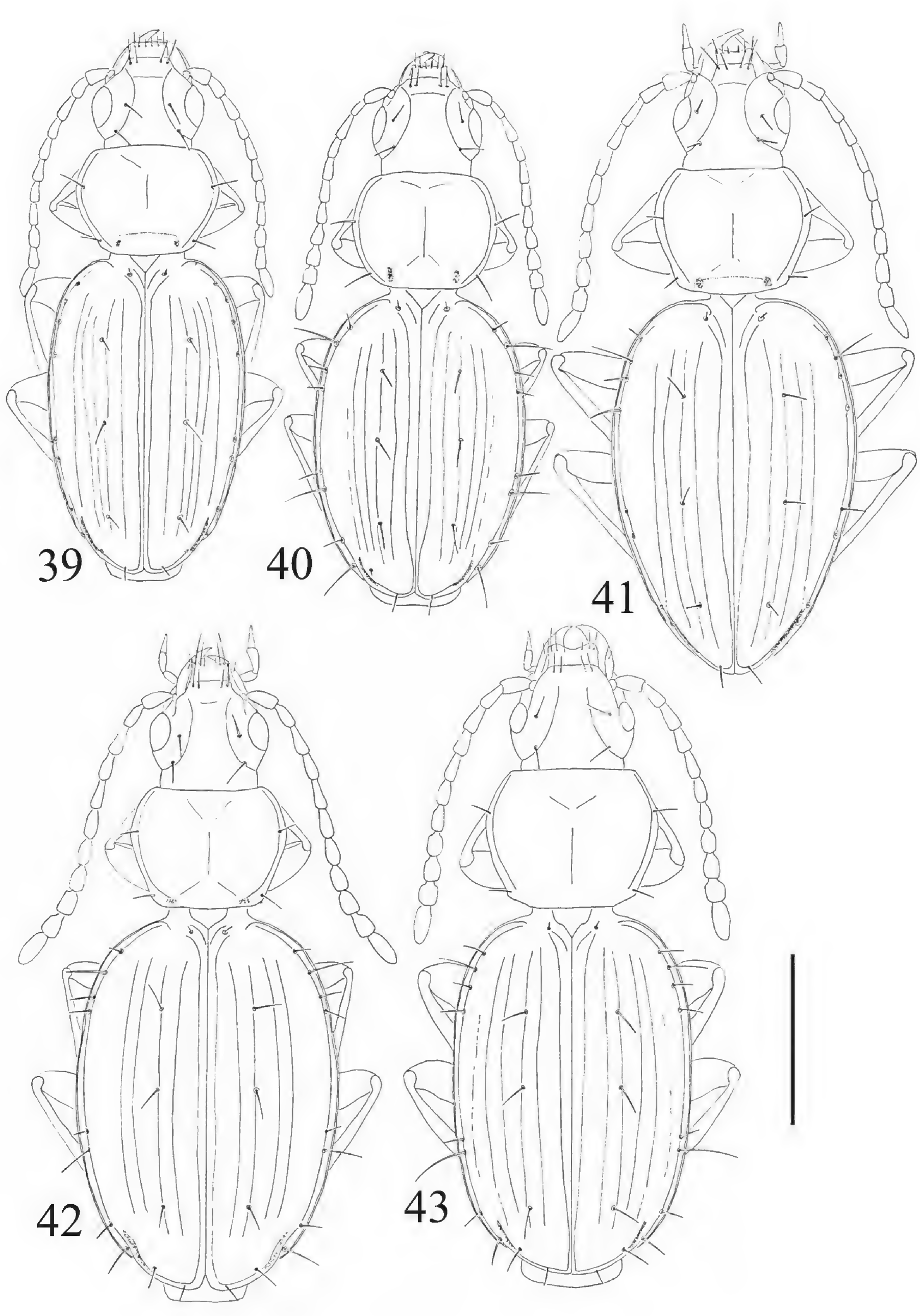
Tasmanorites blackburni (Sloane 1920)
(Figs 41, 49, 50)

Loc. Typ.: Cradle Mountain.

Trechus blackburni Sloane, 1920: 149.
Tasmanorites blackburni Sloane: Jeannel, 1927: 77.
Tasmanorites blackburni (Sloane): Moore, 1972: 24.
Tasmanorites blackburni (Sloane): Casale & Laneyrie, 1982: 59.
Tasmanorites blackburni (Sloane): Moore et al, 1987: 126.
Tasmanorites blackburni (Sloane): Lorenz, 2005: 168.

Type material

LT ♂, Cradle Mtn. Tasmania, Carter & Lea (white, printed), In Moss and Lichens (white, printed), Type (white, printed), *Trechus blackburni* Sl. Id. by T.S. Sloane (white, handwritten and printed), *Trechus blackburni* Sl. Tasmania S. 10816 Type (white, handritten with black and red writing), Lectoholo- *T. blackburni* Sl. PID (red, handwritten), Lectotypus ♂ *Trechus blackburni* Sloane P.M. Giachino det. 2009 (red, handwritten and printed) (SAM). PLTT: 1 ♂ 1 ♀ (on the same card), Cradle Mtn. Tasmania, Carter & Lea (white, printed), co-type (white,



Figs 39-43. Habitus of *Tasmanorites* spp.: 39) *T. tasmaniae* (Blackburn) CT ♂, from Tasmania; 40) *T. daccordii* sp. nov., HT ♂ from Cradle Plateau; 41) *T. blackburni* (Sloane), LT ♂ from Cradle Mtn.(specimen with apex of the elytra deformed and laterally compressed); 42) *T. glaebarum* Moore, ♂ from Mt. Field; 43) *T. intermedius* Moore, ♂ from Mt. Field. Scale: 0.1 mm.

printed), *Trechus blackburni* Sl. Id. by T.S. Sloane (white, handwritten and printed), *Trechus blackburni* Sl. Tasmania S. 19680 Cotype (white, handwritten with black and red writing), Paralectotypus ♂ ♀ *Trechus blackburni* Sloane P.M. Giachino det. 2009 (red, handwritten and printed) (SAM).

Notes

In order to ascertain the validity of *T. daccordii* sp. nov., described above, it was necessary to examine the types of other species from Cradle Mts. including the type series of *T. blackburni* deposited in the SAM, designating the Lectotype. The description by Sloane (1920) and Jeannel (1927) are sufficiently accurate and need no further additions. Moore (1972) provides only very schematic drawings of pronotum and aedeagus; therefore we believe it is useful to supply again the drawing of the habitus (Fig. 41) and the aedeagus (Figs 49, 50) of the Lectotypes.

Distribution and ecology

T. blackburni is known with certainty only from the type locality of Cradle Mts. (Map 7); in our opinion, Moore's indication (1972) of Lake St. Clair deserves further confirmation.

Tasmanorites glaebarum Moore, 1972
(Figs 42, 51)

Loc. Typ.: Mt. Field, Lake Dobson
Tasmanorites glaebarum Moore, 1972: 24.
Tasmanorites glaebarum Moore: Casale & Laneyrie, 1982: 59.
Tasmanorites glaebarum Moore: Moore et al, 1987: 127.
Tasmanorites glaebarum Moore: Donabauer, 2001: 103.
Tasmanorites glaebarum Moore: Lorenz, 2005: 168.

Examined material

1 ♂ 1 ♀, Australia, Tas., Mt. Field N.P., Lake Dobson Rd., m 690, 16.I.2002, P.M. Giachino leg. (CGi).

Notes

The description by Moore (1972) is sufficiently accurate and requires no further additions. Moore, however, provides only the very schematic drawings of pronotum and aedeagus; therefore we believe it is useful to supply again the drawing of habitus (Fig. 42) and aedeagus (Fig. 51).

Distribution and ecology

T. glaebarum is currently known only from the type locality of Mt Field (Moore 1972) (Map 7). The new datum increases significantly the altitudinal range of this species, found at 690 m a.s.l., whereas before it was known only from Lake Dobson at 4000 ft a.s.l. The specimens collected by one of the authors (PMG) were found by sieving litter in a mixed forest.

Tasmanorites intermedius Moore, 1972
(Figs 43, 52)

Loc. Typ.: Mt. Field (3000-4000 ft), Tas.
Tasmanorites intermedius Moore, 1972: 25.
Tasmanorites intermedius Moore: Casale & Laneyrie, 1982: 59.
Tasmanorites intermedius Moore: Moore et al, 1987: 127.
Tasmanorites intermedius Moore: Donabauer, 2001: 103.
Tasmanorites intermedius Moore: Lorenz, 2005: 168.

Examined material

4 ♂♂ 1 ♀, Australia, Tas., Mt. Field N.P., m 650, Lyrebird Track, 7.XII.1998 (moss, sieve), P.M. Giachino leg. (CGi).

Notes

The description by Moore (1972) is sufficiently accurate and requires no further additions. Moore, however, provides only the very schematic drawings of pronotum and aedeagus; therefore we believe it is useful to supply again the drawing of habitus (Fig. 43) and aedeagus (Fig. 52).

Distribution and ecology

T. intermedius is currently known only from the type locality of Mt Field (Moore 1972) (Map 7). The new datum increases significantly the altitudinal range of this species, found at 650 m a.s.l., whereas before it was known at elevations between 3,000 and 4,000 ft a.s.l. The specimens collected by one of the authors (PMG) were found by sieving moss in a mixed forest.

Tasmanorites pullus minor Moore, 1972

Loc. Typ.: Cradle Mountain.
Tasmanorites pullus minor Moore, 1972: 25.
Tasmanorites pullus minor Moore: Casale & Laneyrie, 1982: 59.
Tasmanorites pullus minor Moore: Moore et al, 1987: 128.
Tasmanorites pullus minor Moore: Donabauer, 2001: 102.
Tasmanorites pullus minor Moore: Lorenz, 2005: 168.

Examined material

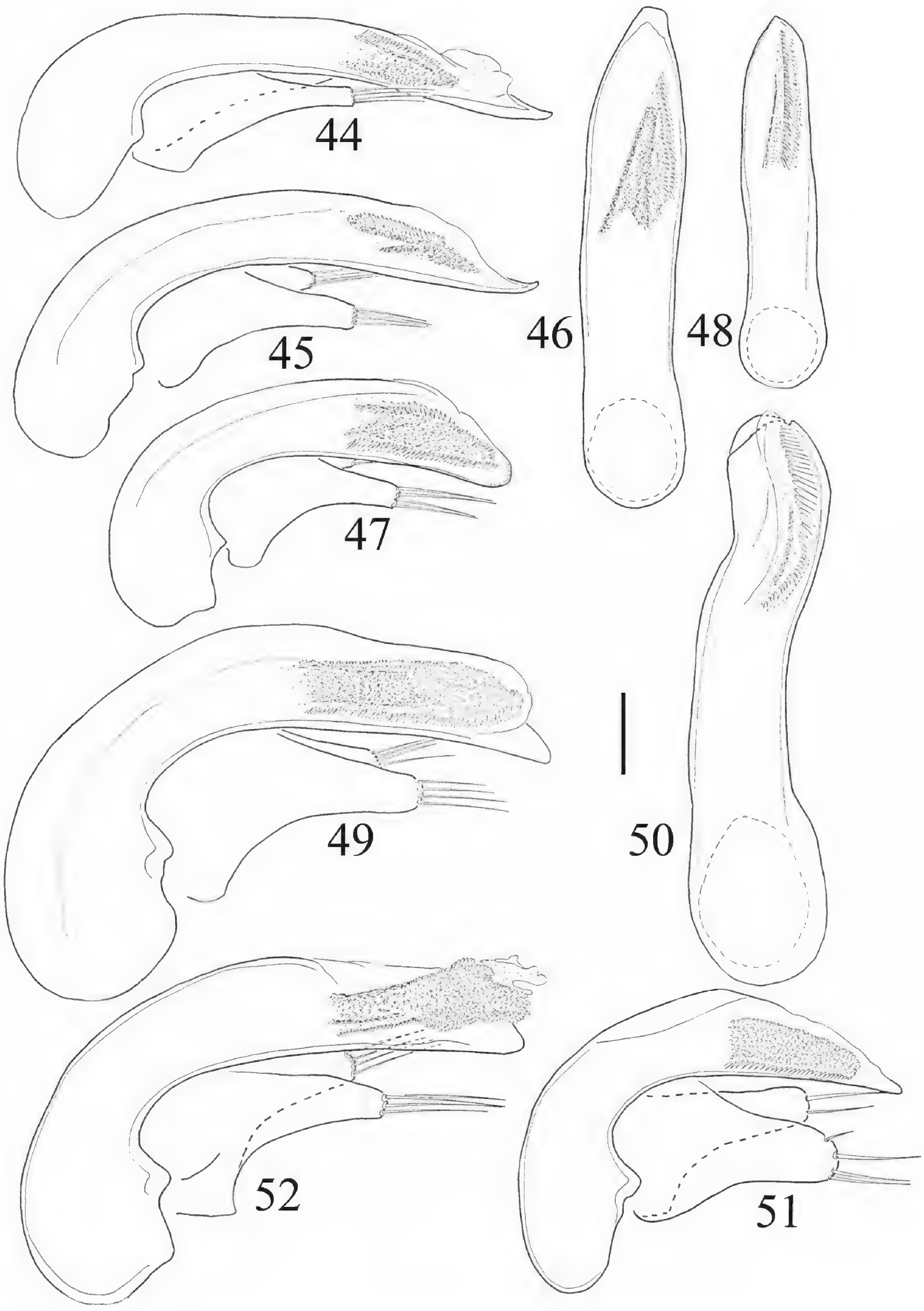
1 ♂, Australia, Tas., Cradle Mts. N.P., Cradle Plateau, m 1200, 25.XI.1999, M. Daccordi leg. (CGi).

Notes

The description by Moore (1972) is sufficiently accurate and requires no further additions. Donabauer (2001) provides a good drawing o f the aedeagus.

Distribution and ecology

T. pullus minor is currently known only from the type locality of Cradle Mts. (Moore 1972) (Map 7).



Figs 44-52. Aedeagus in lateral (44, 45, 47, 49, 52) and dorsal (46, 48, 50) view of *Tasmanorites* spp.: 44) *T. tasmaniae* (Blackburn) HT ♂, from Tasmania; 45, 46) *T. tasmaniae* (Blackburn) CT ♂, from Tasmania; 47, 48) *T. daccordii* sp. nov., HT ♂ from Cradle Plateau; 49, 50) *T. blackburni* (Sloane), LT ♂ from Cradle Mtn.; 51) *T. glaebarum* Moore, ♂ from Mt. Field; 52) *T. intermedius* Moore, ♂ from Mt. Field. Scale: 0.1 mm.

Tasmanorites microphthalmus sp. nov.
(Fig. 53)

Loc. Typ.: Tasmania, Mount Cripps, Philrod Cave, 41°35'S 145°46E.

Type series

HT ♀, Tas., 41°35'S 145°46E, CR3 – 4, Mount Cripps, Philrod Cave, 26.VII.1990, S. Eberhard leg., QVM 12: 437775 (QVML) PT: 1 spec. (remains: elytra and pronotum), Tas., 41°35'S 145°46E, CR3 – 7, Mount Cripps, Philrod Cave, 26.VII.1990, S. Eberhard leg. (CGi).

Diagnosis

A big-sized (mm 4.39) *Tasmanorites*, with a specialized facies, elongated, depigmented, microphthalmous, with long antennae, and cordiform pronotum. Apparently, on the basis of the habitus, it is not similar to any of the known species. It is necessary to know the male before making unnecessary speculations.

Description of HT ♀

Length mm 4.39. Body elongate (Fig. 53), with a relatively small fore-body in comparison with the elytra, which are relatively long and ovate. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes on pronotum and elytra. Metathoracic wings absent. Colour testaceous, with legs, antennomeres, and palpi light testaceous. Head narrow. Clypeus convex at the base, with two apical setae on each side. Eyes small, flat and not prominent. Neck constriction evident. Labrum transverse, with a slightly emarginated apex; mandibles long and slender. Antennae long and slender, longer than the half of the body. Second antennal segment as long as the first one. Pronotum cordiform (PW/PL: 1.11), widest at about 2/3 from the base. Base as narrow as the anterior margin. Sides sinuate before the base, which is evidently bisinuate; hind angles from right to slightly obtuse, and slightly turned out. Front angles not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 3/4 from the base; basal seta present, inserted at the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Elytra broad, oval, and elongate, largest in the middle, slightly convex. Shoulders rounded, with the humeral border continuing inwards almost to the base of the 4th stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible; juxtascutellar stria present; apical recurrent striole long, gently curved, ending at the level of the 6th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; two setiferous pores on the third stria, respectively, a little before the middle and at the apical 5th. One preapical pore placed backwards and closer to the recurrent striole. Male unknown.

Etymology

Its name recalls the strong eye reduction that this species shows.

Distribution and ecology

T. microphthalmus sp. nov. is a troglobite and currently known only from the type locality, Philrod Cave situated in Mount Cripps (NW Tasmania) (Map 7).

Genus *Sloanella* Jeannel, 1927

Type species: *Trechus simsoni* Blackburn, 1894

Sloanella Jeannel, 1927: 84.
Sloanella Jeannel: Moore, 1972: 26.
Sloanella Jeannel: Casale & Laneyrie, 1982: 59.
Sloanella Jeannel:: Moore, 1983: 3.
Sloanella Jeannel: Moore et al, 1987: 127.
Sloanella Jeannel: Lorenz, 2005: 168.

Key to species (after Moore, 1983 modified)

1 Species predominantly dark; elytra 7th interval with a single pore ..... *S. obscura*
- Species predominantly pale; elytra 7th interval without a pore 2
2 Size bigger (length 5 mm or more) ..... *S. suavis*
- Size smaller (length under 4 mm) 3
3 Pronotal hind angles tuberculate; posterior marginal seta present ..... *S. pallida*
- Pronotal hind angles not tuberculate; posterior marginal seta missing 4
4 Pronotal lateral side, before hind angles, strongly sinuate ..... *S. simsoni*
- Pronotal lateral side, before hind angles, not sinuate .. .. *S. gordoni* sp. nov.

Sloanella gordoni sp. nov.
(Figs 54, 55)

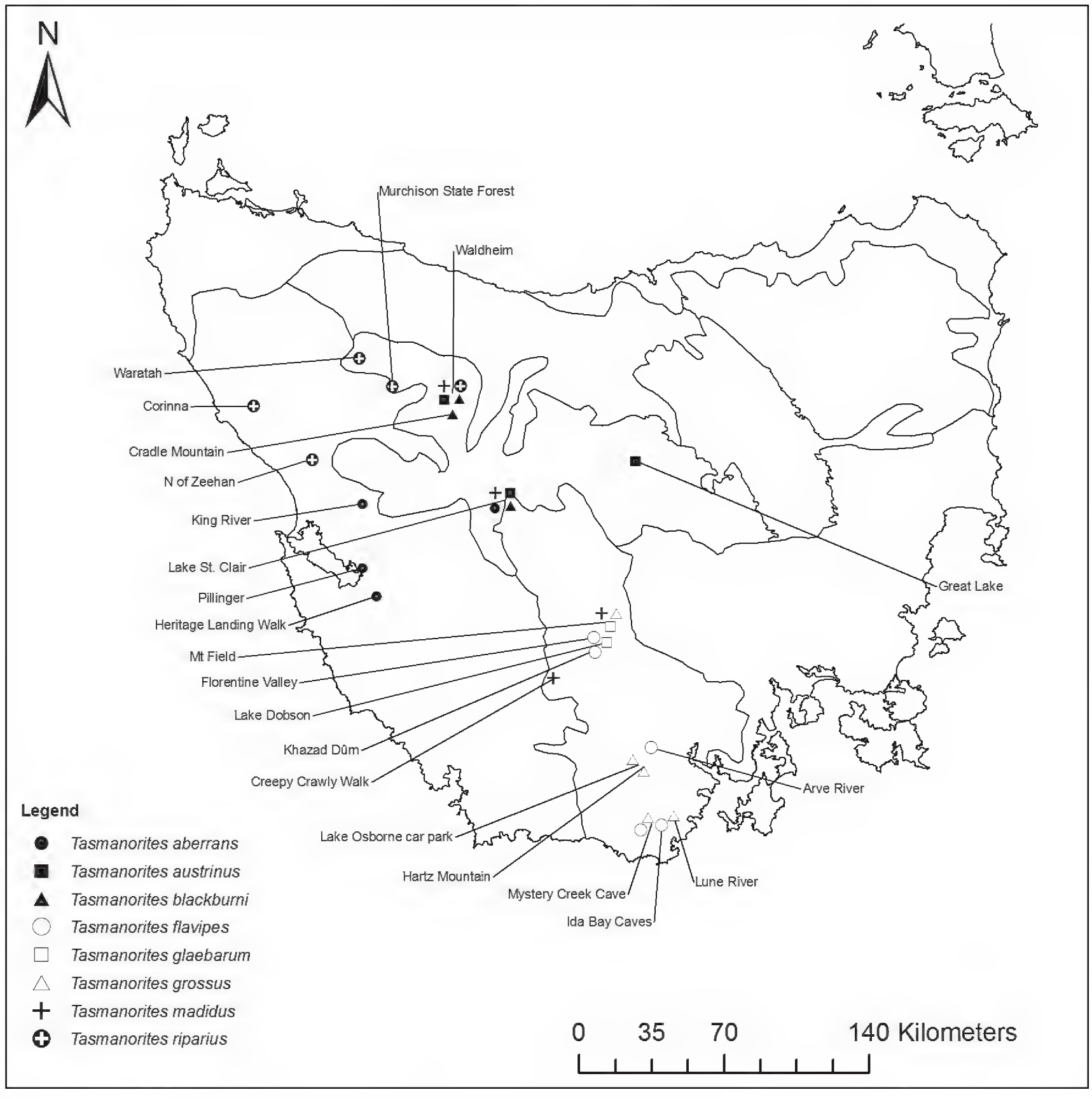
Loc. Typ.: Tasmania, Strahan, Franklin-Gordon Wild River National Park, Gordon River, Heritage Landing Walk.

Type series

HT ♂, Australia, Tas., Strahan, Franklin-Gordon Wild River N.P., Gordon River, Heritage Landing Walk, 25.I.2002, P. M. Giachino leg. (QVML). PT: 1 ♂, Australia, Tas., Strahan, Franklin-Gordon Wild River N.P., Gordon River, Heritage Landing Walk, 25.I.2002, P. M. Giachino leg. (CGi).

Diagnosis

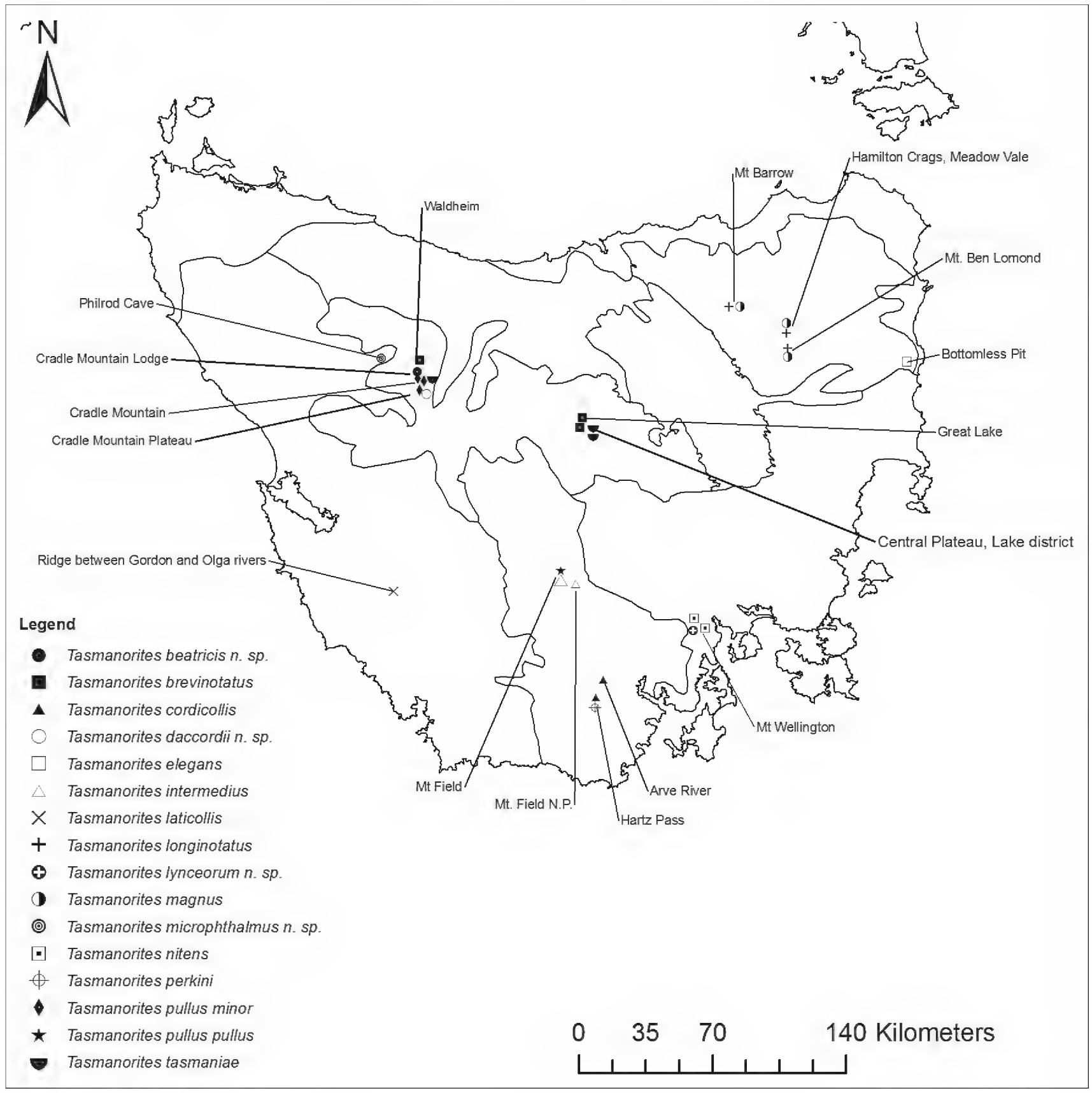
A small-sized (length mm 3.79-3.81) *Sloanella*, with predominantly pale colours. Similar to *S. simsoni* for the missing basal seta of the pronotum and for the general shape of the median lobe of the aedeagus; it differs from this species especially for the sides of the pronotum curved and not sinuate before the basal angles.



Map 6 - Collection sites for *Tasmanorites* spp. known from four or more localities.

Description

Length mm 3.79-3.81 ♂♂. Body stout, obovate (Fig. 54), with a relatively large fore-body in comparison with the elytra, which are short, stout, and ovate. Dorsal surface glabrous and shiny, with the microsculpture isodiametric on the pronotum, as transverse meshes and very lightly impressed on the elytra. Metathoracic wings absent. Colour mostly pale, testaceous, with blackish brown maculae on pronotum and elytra; head pale. Lateral margins and fore-lateral part of the pronotum pale; elytra pale with only a V-shaped dark macula on the posterior half. Legs, antennomeres, and palpi testaceous. Head large. Clypeus convex at the base, with two apical setae on each side. Eyes large, convex, slightly prominent. Neck constriction evident. Labrum transverse, with a deeply emarginated apex; mandibles stout. Antennae short and slender, as long as the half of the body. Second antennal segment as long as the first one. Pronotum transverse (PW/PL: 1.36), widest at about 2/3 from the base. Base narrower than the anterior margin. Sides slightly curved before the base, which is subrectilinear; hind angles obtuse, rounded, and turned out. Front angles not advanced. Lateral margins broad, widening posteriorly; anterior seta inserted just before the middle; basal seta absent. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra short, broad, ovoid, largest in the middle, slightly convex. Shoulders rounded, with the humeral border not continuing inwards. Lateral border of elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible and anastomosed near the tip; juxtascutellar stria present; apical recurrent striole long, gently curved, ending at the level of the 6th stria and with a short apical carina. Chaetotaxis: juxtas-



Map 7 - Collection sites for *Tasmanorites* spp. known from one, two, or three localities.

cutellar pore present; three setiferous pores on the third stria, respectively, at the basal 4th, in the middle, and at the apical 4th. One preapical pore placed backwards and closer to the recurrent striole. Aedeagus (Fig. 55) small (length 0.53 mm), slender; basal bulb small with a large sagittal carina. Median lobe, in lateral view, gently curved, with the apex long, stout, and rounded. Inner sac apically provided with a very small patch of sclerotized scales. Parameres long and moderately stout, reaching the apical 3rd of the median lobe, each one provided with 4 setae. Female unknown.

Etymology

After the banks of the Gordon River along which is the type locality.

Distribution and ecology

S. gordoni sp. nov. is currently known only from the type locality, the Heritage Landing Walk (Gordon River, near Strahan), where it was collected by sieving rainforest litter. In this locality *S. gordoni* sp. nov. coexists with *Tasmanorites aberrans* and *Tasmanotrechus gordoni* sp. nov. Published collection records for five described species in the genus *Sloanella* are shown in Map 8.

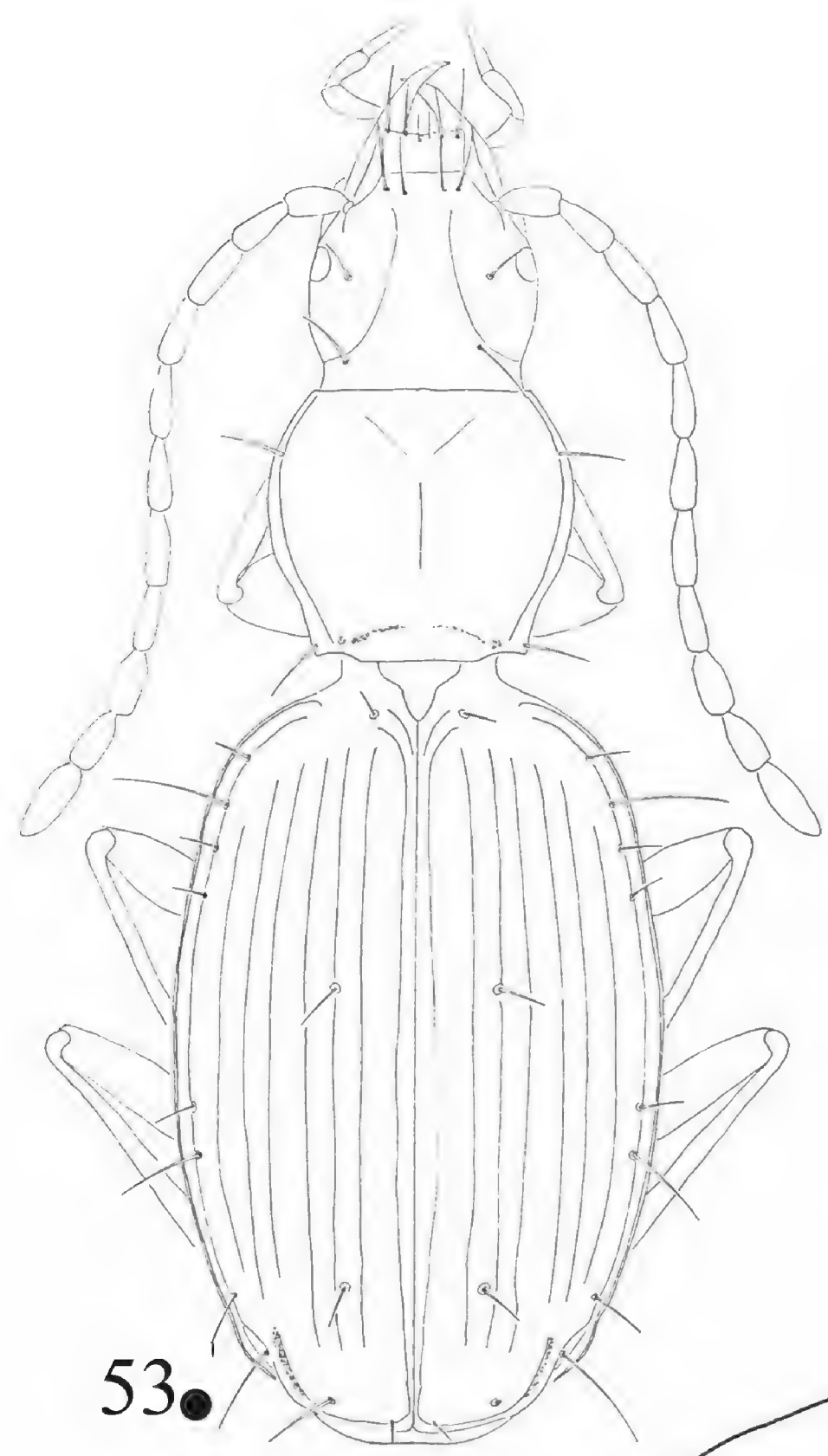
Genus *Tasmanotrechus* Moore, 1972

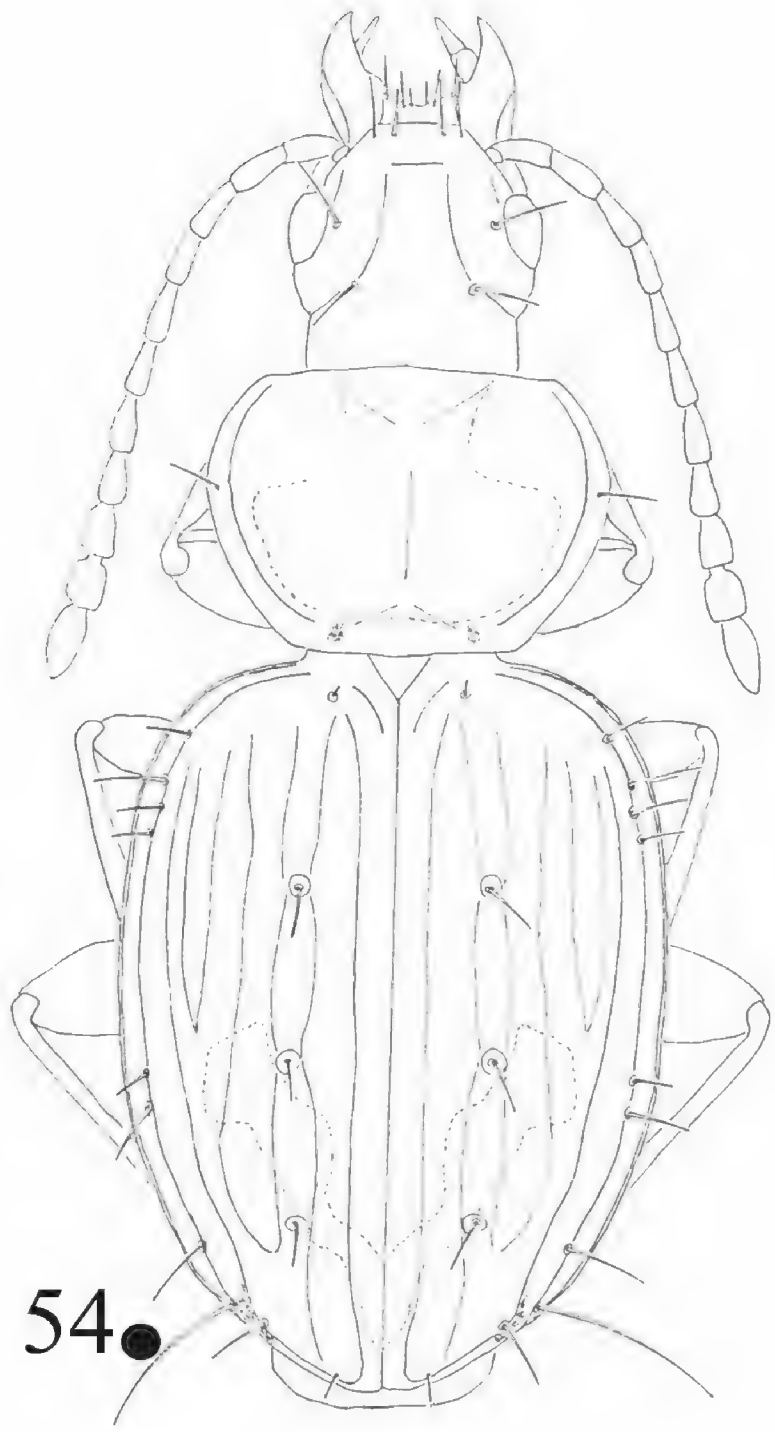
Type species: *Trechus leai* Sloane, 1920.

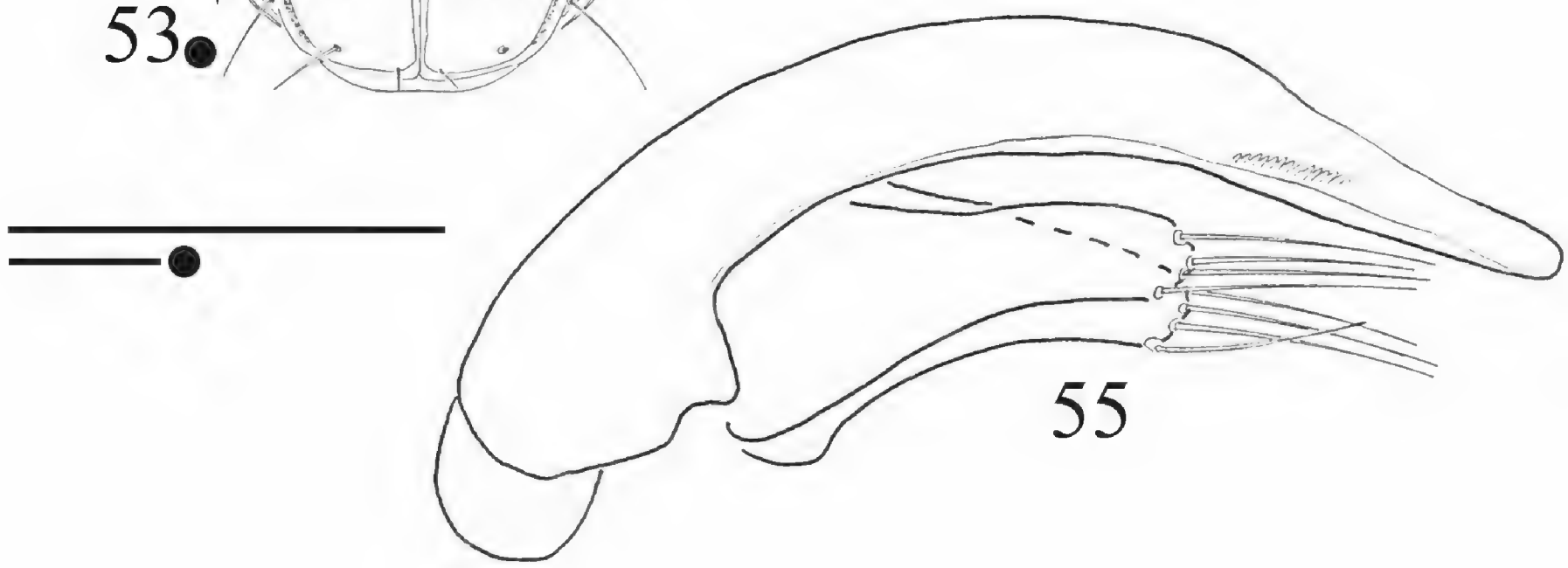
Tasmanotrechus Moore, 1972: 33.
Tasmanotrechus Moore: Casale & Laneyrie, 1982: 61.
Tasmanotrechus Moore: Moore, 1983: 5.
Tasmanotrechus Moore: Moore et al, 1987: 127.
Tasmanotrechus Moore: Moore, 1994: 75.
Tasmanotrechus Moore: Lorenz, 2005: 169.

Key to the species group

1 Lateral side of pronotum, before hind angles, rounded ..... <<*leai* group>>







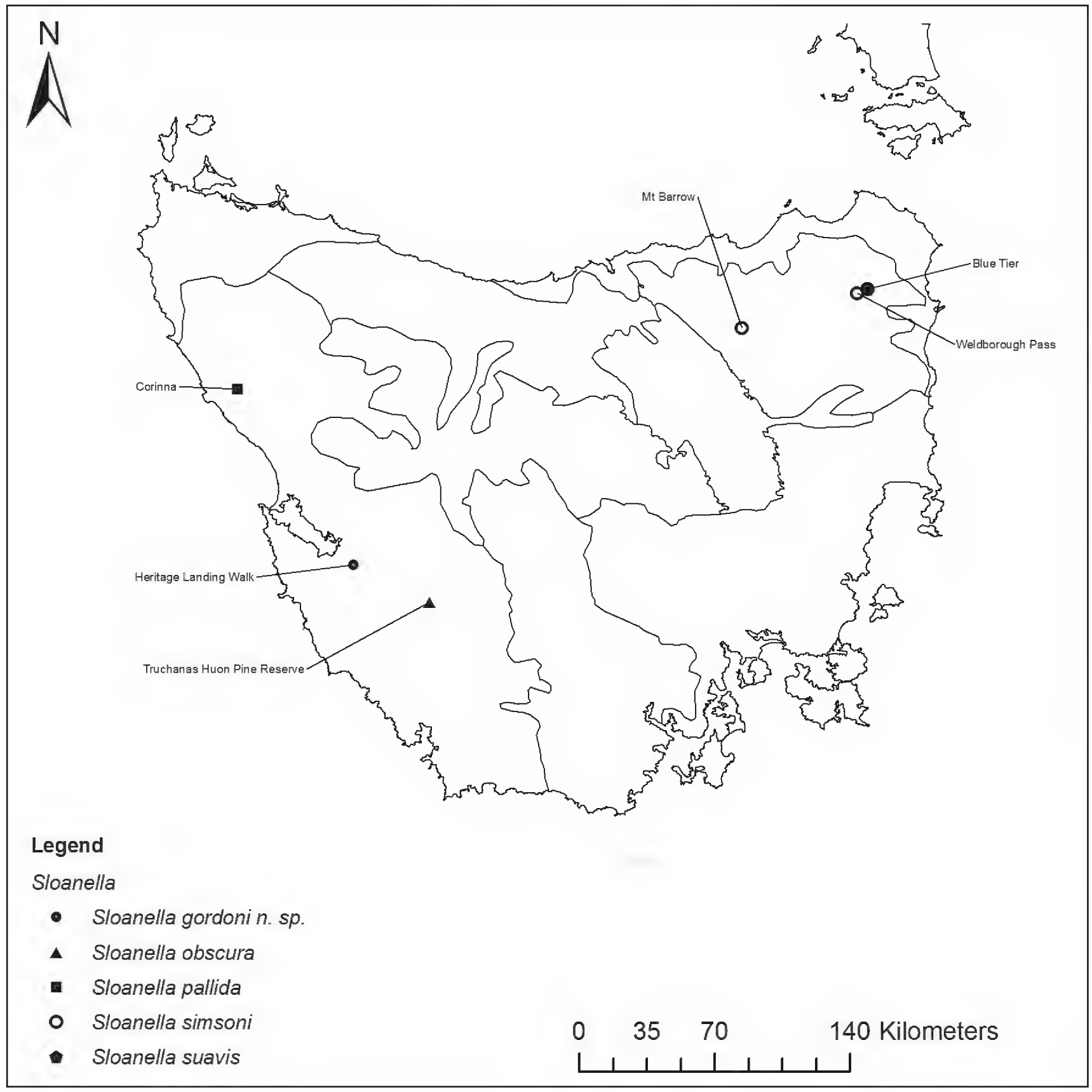
Figs 53-55. Habitus (53, 54) and aedeagus in lateral view (55) of: 53) *Tasmanorites microphthalmus* sp. nov., HT ♀ from Philrod Cave; 54, 55) *Sloanella gordoni* sp. nov., HT ♂ from Heritage Landing Walk. Scale: 0.2 mm.

- Lateral side of pronotum, before hind angles, sinuate.. 2
2 Pronotum always transverse, not cordiform; aedeagus long and slender ..... <<*cockerilli* group>>
- Pronotum cordiform; aedeagus short and stout .... <<*elongatus* group>>

<<*T. leai group*>>

Diagnosis

A group of less specialized forest litter-dwelling species, with less ocular reduction, rounded lateral side of pronotum.



Map 8 - Collection sites for *Sloanella* spp.

As far as we presently known, the following species belong to this species group:

T. leai (Sloane 1920)
T. concolor Moore 1972
T. gordoni sp. nov.
T. alticola sp. nov.
T. montisfieldi sp. nov.
T. compactus Moore, 1983
T. osbornianus sp. nov.

Key to the species (from Moore, 1983 modified)

1 Base of pronotum, wider than the anterior margin... 2
- Base of pronotum, as wide as the anterior margin ..... *T. montisfieldi* sp. nov.
2 Pronotum more transverse (width/length c. 1.25).... 3
- Pronotum less transverse (width/length c. 1.13-1.20).. 5
3 Elytral outer striae weak or obsolescent..... 4
- Elytral outer striae strong ..... *T. osbornianus* sp. nov.
4 Pronotal side margins subrectilinear before the hind angles; elytra broadly ovate..... *T. concolor*
- Pronotal side margins rounded before hind the angles; elytra less rounded at sides ..... *T. compactus*
5. Elytra broadly ovate, strongly wider than pronotum ... . *T. leai*
- Elytra less broad, less rounded at sides and not so wider than pronotum 6
6 Pronotum more transverse (width/length c. 1.20)..... .....*T. gordoni* sp. nov.
- Pronotum less transverse (width/length c. 1.13) ....*T. alticola* sp. nov.

Tasmanotrechus leai (Sloane 1920)
(Figs 56, 63)

Loc. Typ.: Cradle Mts., Tas.
Trechus leai Sloane, 1920: 145.
Trechiella leai Sloane: Jeannel, 1927: 94.
Tasmanotrechus leai (Sloane): Moore, 1972: 34.
Tasmanotrechus leai (Sloane): Casale & Laneyrie, 1982: 61.
Tasmanotrechus leai (Sloane): Moore, 1983: 5.
Tasmanotrechus leai (Sloane): Moore et al, 1987: 130.
Tasmanotrechus leai (Sloane): Lorenz, 2005: 169.

Type material

HT ♀, Cradle Mt, L., H.J.C. 1.18 (white, handwritten); Type (white, printed); *Trechus leai* S. (1918) Id. by T.G. Sloane (white, handwritten and printed); Holotype *T. leai* Sl. P.J.D. (red, handwritten); I. 10808, *Trechus leai* Sln. Tasmania, Type (white with black and red handwriting) (SAM).

Examined material

1 ♂, Tas., 42° 05'S 145° 45'E, BH203- 7 Bubs Hill, Thylacine Lair, 11.VI.1988, S. Eberhard leg. QVM 12: 43781 (QVML).

Notes

The descriptions by Sloane (1920) and Jeannel (1927) are sufficiently accurate and need no further additions. Moore (1972) only provides the drawing, very schematically, of the pronotum, so we believe it is useful to supply the drawing of the habitus (Fig. 56) of the Holotype and of the aedeagus (Fig. 63) of the specimen from Thylacine Lair.

Distribution and ecology

Moore (1972) mistakenly mentions Great Lake as the type locality of this species and adds Waratah as another locality. Subsequently, Moore et al (1987) corrected the mistake regarding the type locality, but maintained the location of Great Lake without confirming it. Our datum of Thylacine Lair (Bubs Hill, NW Tasmania) seems to confirm, for *T. leai*, a relatively large area of distribution, between Waratah to the NW, Bubs Hill to the W, Cradle Mts. to the N, and possibly, Great Lake to the E (Map 10).

Tasmanotrechus gordoni sp. nov.
(Figs 57, 64)

Loc. Typ.: Tasmania, Strahan, Gordon River, Heritage Landing Walk.

Type series

HT ♂, Australia, Tas., Strahan, Gordon River, Heritage Landing Walk, Jan. 1997 (CGi).

Diagnosis

A small-sized (length 4.60 mm) *Tasmanotrechus*, similar in the shape of the body and of the median lobe of the aedeagus to *T. leai*. Well separate from this for the smaller size, for the elytra narrower and parallel, for the pronotum less transverse, and the median lobe of aedeagus more elongated and more abruptedly bent at the base.

Description of the HT ♂

Length mm 4.60. Body elongate (Fig. 57), with a relatively large fore-body in comparison with the elytra, which are short and ovate. Dorsal surface glabrous and shiny, with the microsculpture isodiametric on the pronotum, as transverse meshes on the elytra. Metathoracic wings absent. Colour rufus-testaceous, with antennomeres and palpi testaceous. Head narrow. Clypeus convex at the base, with two apical setae on each side. Eyes large, but flat and not prominent. Neck constriction evident. Labrum transverse, with an emarginated apex; mandibles slender. Antennae short and slender, as long as the half of the body. Second antennal segment as long as the first one.

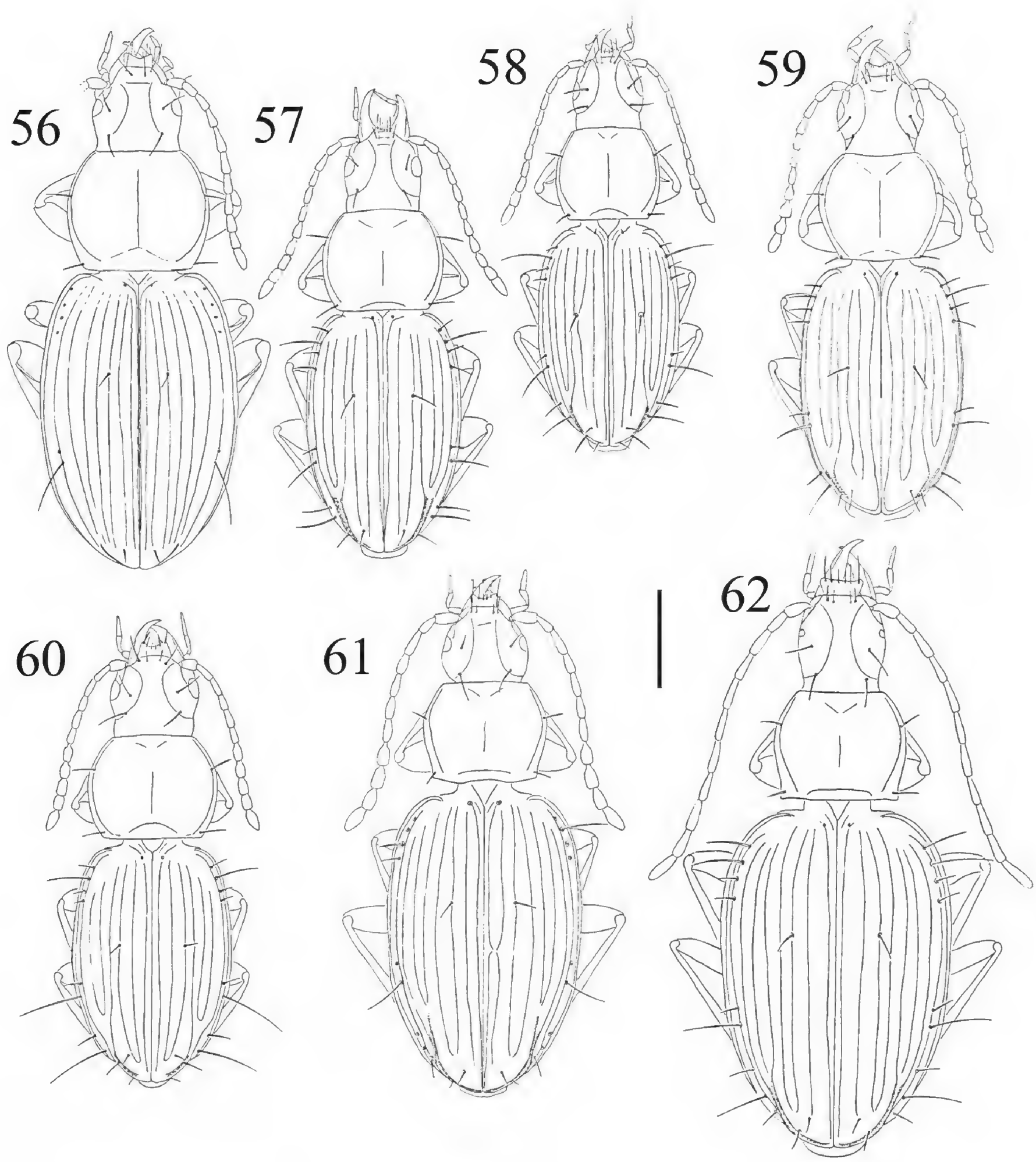
Pronotum transverse (PW/PL: 1.20), widest almost in the middle. Base wider than the anterior margin. Sides slightly curved before the base, which is subrectilinear; hind angles obtuse, but evident. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 2/3 from the base; basal seta present, inserted just before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with undilated protarsomeres. Elytra narrow, oval, widest in the middle, slightly convex. Shoulders rounded but evident, with the humeral border continuing inwards almost to the base of the 4th stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible; juxtascutellar stria short and rudimentary; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; one setiferous dorsal pore on the third stria almost at the basal 3rd. One preapical pore placed backwards and closer to the 3rd stria. Aedeagus (Fig. 64) small (length 0.9 mm), slender; basal bulb small with a large sagittal carina; median lobe, in lateral view, curved in the basal 5th, from gently curved to subrectilinear in the distal part; apex long, slender, with the apical blade acute. Inner sac centrally provided with a small patch of sclerotized scales. Parameres long and moderately slender, reaching the apical half of the median lobe, each one provided with 4 setae. Female unknown.

Etymology

After the Gordon River along the banks of which is the type locality.

Distribution and ecology

T. gordoni sp. nov. is currently known only from the type locality, the Heritage Landing Walk (Gordon River,



Figs 56-62. Habitus of *Tasmanotrechus* spp.: 56) *T. leai* (Sloane), HT ♀ from Cradle Mt.; 57) *T. gordoni* sp. nov., HT ♂ from Heritage Landing Walk; 58) *T. alticola* sp. nov., HT ♂ from Cradle Plateau; 59) *T. montisfieldi* sp. nov., HT ♀ from Mt. Field; 60) *T. osbornianus* sp. nov., HT ♂ from Lake Osborne; 61) *T. moorei* sp. nov., HT ♂ from Kubla Khan Cave; 62) *T. rolani* sp. nov., HT ♂ from Little Trimmer Cave. Scale: 1 mm.

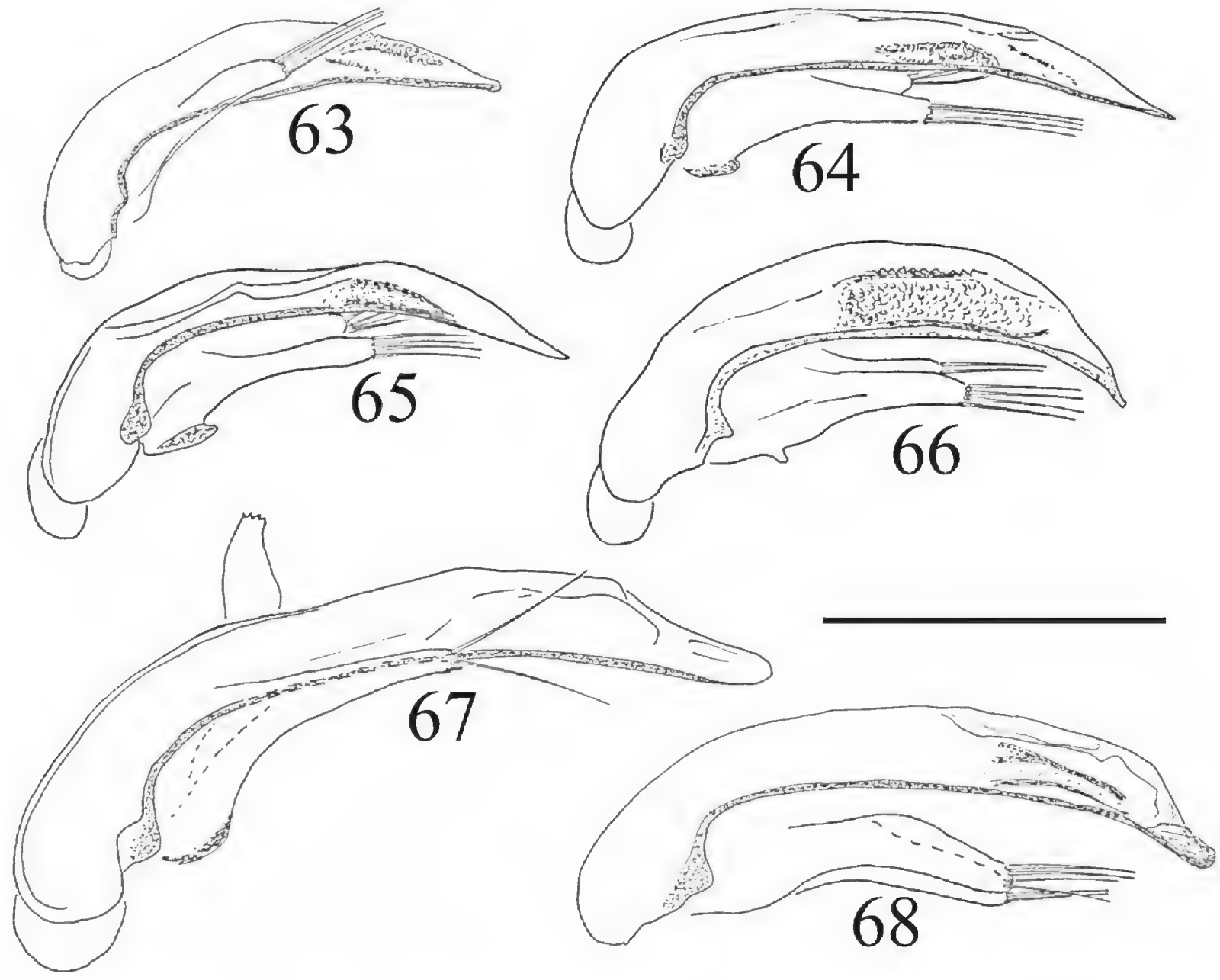
near Strahan) (Map 10). The only known specimen is devoid of additional collecting information. Investigations aimed at finding other specimens of this species, conducted by one of the authors (PMG) have given negative results, permitting instead to collect, in syntopy, two different species of Trechini, *Tasmanorites aberrans* and *Sloanella gordoni* sp. nov.

Tasmanotrechus alticola sp. nov.
(Figs 58, 65)

Loc. Typ.: Tasmania, Cradle Mts. National Park, Cradle Plateau m 1250.

Type series

HT ♂, Australia, Tas., Cradle Mts. N.P., Cradle Plateau m 1250, 31.I.2002, P. M. Giachino leg. (QVML).



Figs 63-68. Aedeagus in lateral view of *Tasmanotrechus* spp.: 63) *T. leai* (Sloane), ♂ from Thylacine Lair; 64) *T. gordoni* sp. nov., HT ♂ from Heritage Landing Walk; 65) *T. alticola* sp. nov., HT ♂ from Cradle Plateau; 66) *T. osbornianus* sp. nov., HT ♂ from Lake Osborne; 67) *T. moorei* sp. nov., HT ♂ from Kubla Khan Cave; 68) *T. rolani* sp. nov., HT ♂ from Little Trimmer Cave. Scale: 0.5 mm.

PT: 1 ♀, Australia, Tas., Cradle Mts. N.P., Cradle Plateau m 1250, 31.I.2002, P. M. Giachino leg. (CGi).

Diagnosis

A small-sized (length mm 4.28-4.32) *Tasmanotrechus*, similar in the shape of the body - particularly its elytra - and of the median lobe of the aedeagus to *T. gordoni*. It is well separate from this by the smaller size, the elytra even narrower and more parallel, the pronotum less transverse, and the median lobe of the aedeagus shorter and more bent in the apical half.

Description

Length mm 4.28 ♂ 4.32 ♀. Body elongate (Fig. 58), with a large fore-body in comparison with the elytra, which are short and ovoidal. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes. Metathoracic wings absent. Colour blackish testaceous, with sutural stria, legs, antennomeres, and palpi testaceous. Head narrow. Clypeus convex at the base, with two apical setae on each side. Eyes large, but flat and not prominent. Neck constriction evident. Labrum transverse, with an emarginated apex; mandibles slender. Antennae short and slender, as long as the half of the body. Second antennal segment as long as the first one. Pronotum transverse (PW/PL: 1.13), widest at about 1/3 from the base. Base larger than the anterior margin. Sides slightly curved before the base, which is subrectilinear; hind angles obtuse, but evident. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 2/3 from the base; basal seta present, inserted just before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with undilated protarsomeres. Elytra narrow, ovoidal, largest in the middle, slightly convex. Shoulders rounded but evident, with the humeral border continuing inwards almost to the base of the 4th stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible; juxtascutellar stria short and well marked; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; one setiferous dorsal pore on the third stria just before the middle. One preapical pore placed backwards and closer to the 3rd stria. Aedeagus (Fig. 65) small (length 0.9 mm), slender, basal bulb small with a large sagittal carina; median lobe,

in lateral view, curved in the basal 5th, gently curved in the distal part; apex long, slender, with the apical blade acute. Inner sac apically provided with a small patch of sclerotized scales. Parameres long and moderately slender, reaching the apical 3rd of the median lobe, each one provided with 4 setae.

Etymology

The name wants to remember the relatively high elevation of the type locality.

Distribution and ecology

T. alticola sp. nov. is currently known only from the type locality of the Cradle Plateau in the Cradle Mts. N.P. (Tasmania) where it was collected by sieving litter under bushes of *Nothofagus* at 1,250 m a.s.l. (Map 10). In this locality *T. alticola* sp. nov. was collected in syntopy with *Tasmanorites daccordii* sp. nov.

Tasmanotrechus montisfieldi sp. nov.
(Fig. 59)

Loc. Typ.: Tasmania, Mt. Field National Park, road for Lake Dobson, m 700.

Type series

HT ♀, Australia, Tas., Mt. Field N.P., road for Lake Dobson, m 700, Jan. 1997 (CGi).

Diagnosis

A small-sized (length 4.9 mm) *Tasmanotrechus*, similar in the shape of the body, and in particular of the elytra, to *T. alticola* and *T. gordoni*. Well separate from them for the bigger size, the pronotum with a narrow base, and the presence of a long and well marked juxtascutellar stria.

Description of the HT ♀

Length mm 4.9. Body elongate (Fig. 59), with a large fore-body in comparison with the elytra, which are short and ovoidal. Dorsal surface glabrous and shiny, with the microsculpture isodiametric on the pronotum, as transverse meshes on elytra. Metathoracic wings absent. Colour blackish testaceous, with sutural stria, legs, antennomeres, and palpi testaceous. Head narrow. Clypeus convex at the base, with two apical setae on each side. Eyes less reduced, flat and not prominent. Neck constriction evident. Labrum transverse, with an emarginated apex; mandibles slender. Antennae short and slender, as long as the half of the body. Second antennal segment as long as the first one. Pronotum transverse (PW/PL: 1.13), widest at about 2/3 from the base. Base as wide as the anterior margin. Sides slightly curved to subrectilinear before the base, which is subrectilinear; hind angles obtuse, but pointed and evident. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 2/3 from the base; basal seta present, inserted just before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Disal surface gently convex. Elytra narrow, ovoidal, largest in the middle, slightly convex. Shoulders rounded but evident, with the humeral border continuing inwards almost to the base of the 4th stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible; juxtascutellar stria long and well marked; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; one setiferous dorsal pore on the third stria just before the middle. One preapical pore placed backwards and closer to the 3rd stria. Male unknown.

Etymology

After the type locality of Mt. Field.

Distribution and ecology

T. montisfieldi sp. nov. is currently known only from the type locality of Mt Field, where it was collected at 700 m a.s.l. along the road to Lake Dobson (Map 10). The only known specimen does not bear any other collection data. Investigations conducted by one of the authors (PMG), aimed at finding other specimens, gave negative results, but enabling the finding, in this area, of other species of Trechinae, such as *Sloaneana tasmaniae*, *Tasmanorites glaebarum*, and *Mecyclothorax punctipennis*.

Tasmanotrechus osbornianus sp. nov.
(Figs 60, 66)

Loc. Typ.: Tasmania, Hartz Mts., Lake Osborne.

Type series

HT ♂, Australia, Tas., Hartz Mts., Lake Osborne, Jan. 1997 (CGi).

Diagnosis

A small-sized (length 4.73 mm) *Tasmanotrechus*, similar in the shape of the body, and in particular of pronotum and elytra, to *T. gordoni*. Well separate from this by the larger head, and the median lobe of the aedeagus, shorter, stocky, and more bent in the apical half. The male of *T. osbornianus* sp. nov. has also, unlike *T. leai*, *T. gordoni* sp. nov., and *T. alticola* sp. nov., the first two protarsomeres distinctly dilated.

Description of the HT ♂

Length mm 4.73. Body elongate (Fig. 60), with a large fore-body in comparison with the elytra, which are short and ovoidal. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes. Metathoracic wings absent. Colour blackish testaceous, with sutural stria, legs, antennomeres, and palpi testaceous. Head wide. Clypeus convex at the base, with two apical setae on each side. Eyes large, but flat and not prominent. Neck constriction evident. Labrum transverse, with an emarginated apex; mandibles slen-

der. Antennae very short and slender, shorter than the half of the body. Second antennal segment as long as the first one. Pronotum transverse (PW/PL: 1.25), widest almost in the middle. Base wider than the anterior margin. Sides slightly curved before the base, which is subrectilinear; hind angles obtuse, but evident. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 2/3 from the base; basal seta present, inserted just before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra narrow, ovoidal, widest in the middle, slightly convex. Shoulders rounded but evident, with the humeral border continuing inwards almost to the base of the 4th stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible; juxtascutellar stria short and rudimentary; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; one setiferous dorsal pore on the third stria just before the middle. One preapical pore placed backwards and closer to the 3rd stria. Aedeagus (Fig. 66) small (length 0.8 mm), relatively stout, basal bulb small with a large sagittal carina; median lobe, in lateral view, curved in the basal 5th, gently and regularly curved in the distal part; apex long, slender, with the apical blade acute. Inner sac centrally provided with a small patch of sclerotized scales. Parameres long and moderately slender, reaching the apical 3rd of the median lobe, each one provided with 4 setae. Female unknown.

Etymology

After the type locality of Lake Osborne.

Distribution and ecology

T. osbornianus sp. nov. is currently known only from the type locality, Lake Osborne in the Hartz Mts. National Park (S Tasmania) (Map 9), where it was collected in summer (January). There are no other collecting data. Investigations made in search of other specimens and conducted personally by one of the authors (PMG) at Lake Osborne at a height of 900 m a.s.l. in January 2002 were fruitless.

<<*T. elongatus* group>>

Diagnosis

Specialized cave-dwelling form characterized by ocular reduction, cordiform pronotum with sinuate lateral sides, aedeagus short and stout. To date, only one species displaying these characters has been described, *T. elongatus* Moore, 1994, a troglobite recorded from caves in the Bubs Hill karst in western Tasmania (Moore 1994) (Map 9).

<<*T. cockerilli* group>>

Diagnosis

A group of specialized cave-dwelling species, with ocular reduction, pronotum transverse with sinuate lateral sides, aedeagus long and slender.

As far as we presently known, the following species belong to this species group:

T. cockerilli Moore, 1972
T. moorei sp. nov.
T. rolani sp. nov.

Key to the species

1 Size smaller (length 5.34 mm); eyes less reduced .... *T. moorei* sp. nov.
- Size bigger (length 6.0-6.5 mm); eyes more reduced.. 2
2 Pronotum less transverse (width/length c. 1.10) .... *T. cockerilli*
- Pronotum more transverse (width/length c. 1.20) .... *T. rolani* n. sp

Tasmanotrechus cockerilli Moore, 1972

Loc. Typ.: George's Hall Cave, Mole Creek, Tas.
Tasmanotrechus cockerilli Moore, 1972: 36.
Tasmanotrechus cockerilli Moore: Casale & Laneyrie, 1982: 61.
Tasmanotrechus cockerilli Moore: Moore, 1983: 5
Tasmanotrechus cockerilli Moore: Moore, 1994: 76.
Tasmanotrechus cockerilli Moore: Moore et al, 1987: 130.
Tasmanotrechus cockerilli Moore: Lorenz, 2005: 169.

Examined material

1 ♀, Tasmania, Mole Creek Scott's Cave, 23.XII.1974, S. Uéno leg. (CGi).

Notes

The description by Moore (1972) is sufficiently accurate and needs no other additions.

Distribution and ecology

Moore (1972) mentions *T. cockerilli* from several caves in the Mole Creek karst: Georgie's Hall Cave, Scott's Cave, Herbert's Pot, and Baldock's Cave. The species is troglobitic.

Tasmanotrechus moorei sp. nov.
(Figs 61, 67)

Loc. Typ.: Tasmania, Mole Creek, Kubla Khan Cave, 41°30'S 146°20'E.

Type series

HT ♂, Tas. 41°30'S 146°20'E, MC1-59, Mole Creek, Kubla Khan Cave, under stone, near litter, riparian silt-

bank, Caim Hall, deep zone, 31.X.1990, S. Eberhard leg. QVM 12: 780 (QVML).

Diagnosis

A relatively small-sized (mm 5.34) *Tasmanotrechus* of the "*cockerilli* group", clearly distinguishable from the other two known species of the group for the eyes less reduced and the antennae shorter.

Description of the HT ♂

Length mm 5.34. Body stout (Fig. 61), with a relatively large fore-body in comparison with the elytra, which are long, wide, and ovoidal. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes. Metathoracic wings absent. Colour entirely testaceous. Head wide. Clypeus convex at the base, with two apical setae on each side. Eyes reduced, flat and not prominent. Neck constriction evident. Labrum transverse, with an emarginated apex; mandibles slender. Antennae relatively short and slender, as long as the half of the body. Pronotum transverse (PW/PL: 1.25), widest at about the 2/3 from the base. Base wider than the anterior margin. Sides sinuate before the base, which is bisinuate; hind angles straight, evident and upturned. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 2/3 from the base; basal seta present, inserted just before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra broad, ovoidal, widest in the middle, slightly convex. Shoulders rounded but evident, with the humeral border continuing inwards almost to the base of the 4th stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible; juxtascutellar stria short and well marked; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; one setiferous dorsal pore on the third stria before the middle. One preapical pore placed backwards and near to the 3rd stria. Aedeagus (Fig. 67) large (length 1.16 mm), long, and narrow; basal bulb small with a large sagittal carina; median lobe, in lateral view, curved in the basal 6th, gently and regularly curved in the distal part; apex long, slender, with the apical blade rounded. Inner sac unarmed. Parameres long and moderately slender, not reaching the apical 3rd of the median lobe, each one provided with 4 setae. Female unknown.

Etymology

We are glad to dedicate this species to Barry P. Moore as a sign of appreciation for the important role played in the knowledge of the Australian carabid fauna.

Distribution and ecology

T. moorei sp. nov. is currently known only from the type locality: Kubla Khan Cave, near Mole Creek, Tasmania (Map 9), where it lives in sympatry with another species of troglobitic *Tasmanotrechus* of the same group of species, but more specialized to subterranean life, *T. rolani* sp. nov.

Tasmanotrechus rolani sp. nov.
(Figs 62, 68)

Loc. Typ.: Tasmania, Mole Creek, Little Trimmer Cave, 41°30'S 146°20'E.

Type series

HT ♂, Tas. 41°30'S 146°20'E, MC39-1, Mole Creek, Little Trimmer Cave, Siltbank in end chamber, deep zone, 23.V.1990, Rolan Eberhard leg., QVM 12: 43777 (QVML). PTT: 2 spec. (remains: elytra), Tas. 41°30'S 146°20'E, MC39-1, Mole Creek, Little Trimmer Cave, Siltbank in end chamber, deep zone, 23.V.1990, Rolan Eberhard leg., QVM 12: 43777 (QVML, CGi); 1 ♀, Tas. 41°30'S 146°20'E, MC1-85, Mole Creek, Kubla Khan Cave, under stone, near litter, riparian siltbank, Caim Hall, deep zone, 31.X.1990, S. Eberhard leg. (CGi); 1 spec. (remains), Tas. 41°30'S 146°20'E, MC1-29, Mole Creek, Kubla Khan Cave, on siltbank, Caim Hall, deep zone, 23.X.1990, S. Eberhard leg. (QVML); 2 spec. (remains), Tas. 41°30'S 146°20'E, MC1-23, Mole Creek, Kubla Khan Cave, on siltbank, Caim Hall, deep zone, 20-26.X.1990, S. Eberhard leg. (QVML); 3 spec. (remains), Tas. 41°30'S 146°20'E, MC1-23, Mole Creek, Kubla Khan Cave, on flowstone in Dulcimer chamber at top of cracked slab., deep zone, 20-26.X.1990, S. Eberhard leg., QVM 12: 43778 (QVML); 3 spec. (remains: elytra), Tas. 41°30'S 146°20'E, MC38-19, Mole Creek, Genghis Khan Cave, top of Aragonite chamber near tree roots, deep zone, 19.X.1990, S. Eberhard leg., QVM 12: 43: 779 (QVML).

Diagnosis

A large-sized (mm 6.13-6.17) *Tasmanotrechus* of the "*cockerilli* group", clearly distinguishable from *T. moorei* sp. nov. by the eyes smaller and the antennae longer. It is well distinquishable from *T. leai* by the head narrower and more elongated, and by the pronotum more transverse.

Description

Length mm 6.13 ♂ 6.17 ♀. Body stout (Fig. 62), with a relatively small fore-body in comparison with the elytra, which are long, wide, and ovoidal. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes. Metathoracic wings absent. Colour entirely testaceous. Head narrow. Clypeus convex at the base, with two apical setae on each side. Eyes very reduced. Neck constriction evident. Labrum transverse, with a

slightly emarginated apex; mandibles slender. Antennae long and slender, longer than the half of the body. Pronotum transverse (PW/PL: 1.20), widest almost in the middle. Base wider than the anterior margin. Sides sinuate before the base, which is slightly bisinuate; hind angles straight, evident, and upturned. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 2/3 from the base; basal seta present, inserted just before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra very broad, ovoidal, widest at the anterior 3rd, slightly convex. Shoulders rounded but evident, with the humeral border continuing inwards almost to the base of the 4th stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible, but gently impressed; juxtascutellar stria short and rudimentary; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; one setiferous dorsal pore on the third stria before the middle. One preapical pore placed backwards and near to the 2nd stria. Aedeagus (Fig. 68) small (length 0.93 mm), long, and narrow; basal bulb small with a large sagittal carina; median lobe, in lateral view, curved in the basal 6th, gently and regularly curved in the distal part; apex short, slender, with the apical blade rounded. Inner sac apically provided with a large patch of sclerotized scales. Parameres long and moderately slender, reaching the apical 3rd of the median lobe, each one provided with 4 setae.

Etymology

We are glad to dedicate this new species to Rolan Eberhard who collected the first specimens.

Distribution and ecology

T. rolani sp. nov. is currently known from three caves in the Mole Creek karst area: Little Trimmer Cave, Kubla Khan Cave, and Genghis Khan Cave (Map 9). In Kubla Khan Cave *T. rolani* sp. nov. lives in sympatry with another troglobitic species of *Tasmanotrechus* of the same group of species, but less specialized, *T. moorei* sp. nov.

Taxonomic comments

Within the genus *Tasmanotrechus* three distinct groups can be recognized based on morphology. The "*T. leai* group" includes seven species typically occurring in forest litter. They are, pigmented, pronotum with rounded sides, not sinuate posteriorly, characterized by a mild ocular reduction but not highly specialized for life in deep subterranean environments. All species are morphologically well differentiated and geographically vicariant. Within this group *T. leai*, *T. concolor*, *T. gordoni* sp. nov., *T. alticola* sp. nov., and *T. montisfieldi* sp. nov. appear morphologically similar to eachother, while *T. compactus* and *T. osbornianus* sp. nov. are most similar to eachother. Species in the "*T. leai* group" have been collected from three IBRA regions in central, western and southern Tasmania (Map 9).

The other two "groups", referred to as the "*T. elongatus* group" and "*T. cockerilli* group", include species that are morphologically more adapted to the subterranean environment in terms of depigmentation, and characterized by a more or less enhanced ocular reduction and pronotum with sides sinuate posteriorly. These two "groups" of troglobites are geographically vicariant; the *T. elongatus* form occurs in caves of the Bubs Hill karst in western Tasmania, while the "*T. cockerilli* group" comprises at least three species recorded from caves in the Mole Creek karst in northern Tasmania. While the *T. elongatus* "group" is monospecific, within the group of *T. cockerilli* all three species are morphologically well differentiated, two of which *T. cockerilli* and *T. rolani* sp. nov. are more specialized and one, *T. moorei* sp. nov., is less specialized. The interesting zoogeographic datum is that two of these species, with a different degree of specialization, are sympatric in Kubla Khan Cave, which suggests heterochronic colonisations of the hypogean environment.

Genus *Goedetrechus* Moore, 1972

Type species: *Goedetrechus talpinus* Moore, 1972.
Goedetrechus Moore, 1972: 36.
Goedetrechus Moore: Casale & Laneyrie, 1982: 63.
Goedetrechus Moore: Moore et al, 1987: 130.
Goedetrechus Moore: Lorenz, 2005: 169.

Key to the species group

1 Eyes traceable, though very reduced..... 2
- Eyes absent.....<<*mendumae* group>>
2 Base of the pronotum markedly lobate. Eyes reduced.. .....<<*talpinus* group>>
- Base of the pronotum truncate. Eyes traceable ....<<*parallelus* group>>

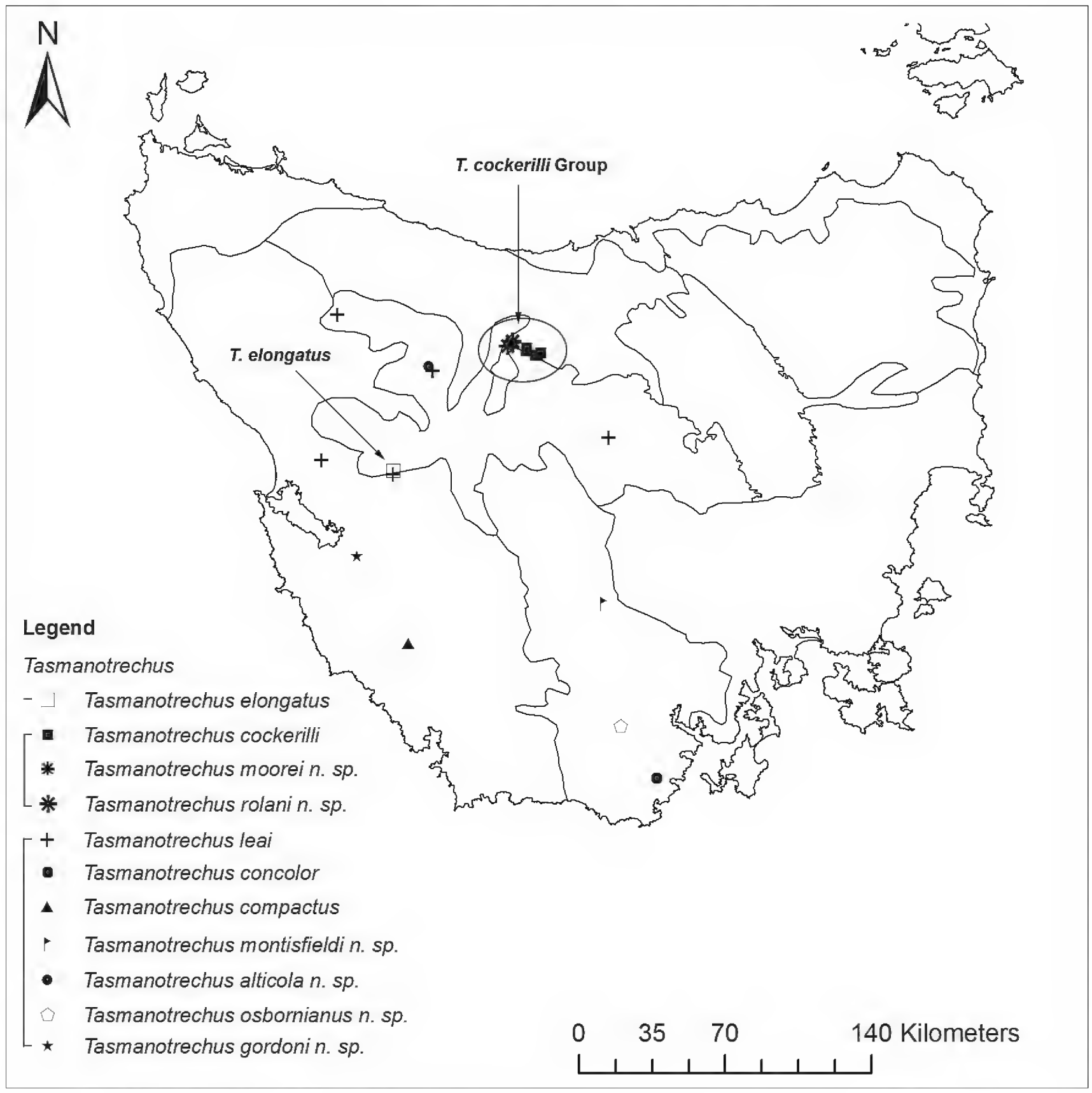
<<*G. talpinus* group>>

Diagnosis

A form less specialized to subterranean life – likely "endogeous" after Moore (1972) but probably a forest litter-dwelling species - with less ocular reduction and pronotum less cordiform.

Distribution and ecology

G. talpinus Moore, 1972, is the only representative of this "group" currently described. It is geographically isolated, and recorded only from a montane habitat (Blue Tier) in northeast Tasmania.



Map 9 - Collection sites for *Tasmanotrechus* spp.

<<*G. parallelus* group>>

Diagnosis

A group of specialized cave-dwelling species, with eyes reduced or vestigial.

The following described species belong to this group:

G. parallelus Moore, 1972
G. rolani sp. nov.
G. florentinus sp. nov.
G. minutus sp. nov.

Key to the species

1. Size bigger (c. mm 4.9-5.1). Pronotum more elongate. 2
- Size smaller (c. mm 4.13). Pronotum less elongate ... . *G. minutus* sp. nov.

2. Head globose, lateral side of the pronotum posteriorly slightly sinuate ... *G. rolani* sp. nov.
- Head elongate, lateral side of the pronotum posteriorly very sinuate ... *G. florentinus* sp. nov.

Goedetrechus minutus sp. nov.
(Fig. 69)

Loc. Typ.: Tasmania, Junee-Florentine, Niggly Cave, 42°40'S 146°30'E

Type series

HT ♀, Tas., 42°40'S 146°30'E, Junee-Florentine, JF237-1, Niggly Cave, deep zone, 28.IV.1990, S. Eberhard leg., QVM 12: 43773 (QVML).

Diagnosis

A *Goedetrechus* of the *parallelus* group, characterized by the small size (4.13 mm) and the relatively poorly elongated pronotum, similar in this to *G. parallelus*. It is

well separate from this by the elytra narrower and more elongated.

Description of the HT ♀

Length mm 4.13. Body elongate (Fig. 69), with a small fore-body in comparison with the elytra, which are elongated and subparallel. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes. Metathoracic wings absent. Colour entirely testaceous. Head narrow. Clypeus convex at the base, with two apical setae on each side. Eyes reduced to a very small macula. Neck constriction evident. Labrum transverse, with an emarginated apex; mandibles long and slender. Antennae very long and slender, longer than the half of the body. Pronotum cordiform (PW/PL: 0.97), widest at about the basal 3rd. Base narrower than the anterior margin. Sides sinuate before the base, which is bisinuate; side only very slightly curved anteriorly; hind angles straight, evident and upturned. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 3/4 from the base; basal seta present, inserted at the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Elytra elongated and subparallel, widest in the middle, slightly convex. Shoulders rounded, slightly evident, with the humeral border not continuing inwards. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible, but gently impressed; juxtascutellar stria present but short and very slightly impressed; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; two setiferous pores on the third stria, the first one at the basal 4th, the second one in the middle. One preapical pore placed backwards and near to the 2nd stria. Male unknown.

Etymology

The name wants to remember the small size of the species.

Distribution and ecology

G. minutus sp. nov. is currently known only from the type locality of Niggly Cave, located in the Junee-Florentine karst in southern Tasmania (Map 9). The only known specimen of this species was collected from riparian mudbanks at approximately 350 metres depth in the cave.

Goedetrechus rolani sp. nov.
(Figs 70, 73)

Loc. Typ.: Tasmania, Junee-Florentine, Pendant Pot, 42°40'S 146°35'E.

Type series

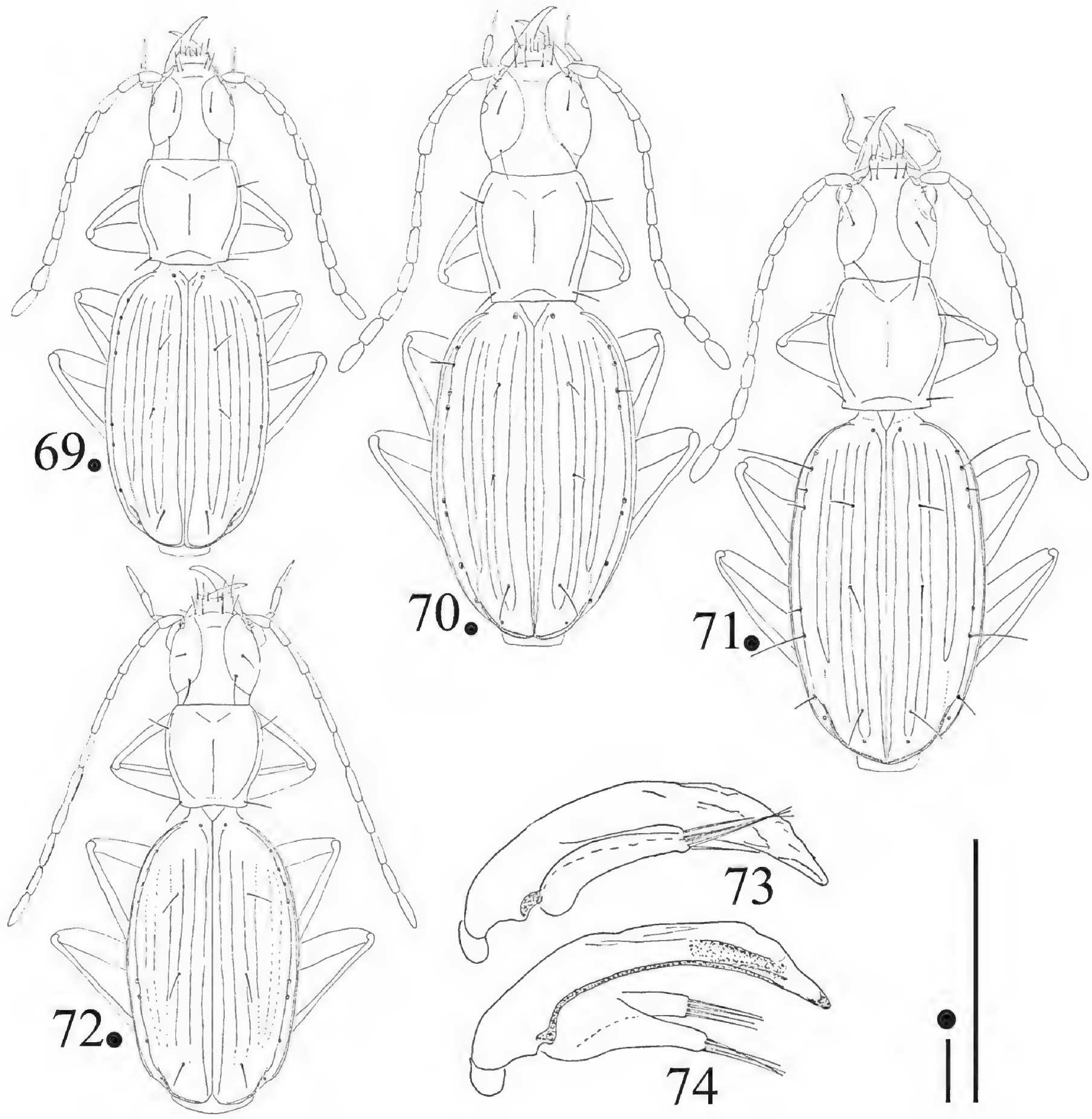
HT ♂, Tas., 42°40'S 146°35'E, JF37-8, Junee-Florentine, Pendant Pot, April 1984, Rolan Eberhard leg., QVM 12: 43769 (QVML). PTT: 1 ♀, Tas., 42°40'S 146°27'E, Junee-Florentine Windy Rift, Growling Swallet Cave, wood & litter on bank, deep zone, JF36-6, 26.III.1989, S. Eberhard leg. (CGi); 1 ♀, (immature), Tas., 42°40'S 146°27'E, Junee-Florentine, Junee-Florentine Windy Rift, Growling Swallet Cave, 13.V.1990, S. Eberhard leg.. QVM 12: 768 (QVML); 1 ♀, Tas., 42°40'S 146°30'E, Junee-Florentine, Wherrets Cave, JF-X6-5, 26.XII.1989, S. Eberhard leg., QVM 12: 43770 (QVML); 1 spec. (remains), Tas., 42°42'S 146°35'E, JF341-5, Junee-Florentine, Threefortyone Cave, deep zone July 1988, S. Eberhard leg. QVM 12: 43771 (QVML).

Diagnosis

A large-sized (4.93-5.05 mm) *Goedetrechus* of the *parallelus* group, with an elongated pronotum, similar in this to *G. florentinus* sp. nov.; it is well-differentiated from the latter by the macrocephaly, the shape of the pronotum, and the elitra with less parallel sides. It differs from *G. florentinus* also for the median lobe of the aedeagus, in lateral view, with a much greater diameter.

Description

Length mm 4.93 ♂ 5.0-5.05 ♀♀. Body elongate (Fig. 70), with a small fore-body in comparison with the elytra, which are elongated and subparallel. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes. Metathoracic wings absent. Colour entirely testaceous. Head large and globose. Clypeus convex at the base, with two apical setae on each side. Eyes reduced to a very small macula. Neck constriction evident. Labrum transverse, with a deeply emarginated apex; mandibles long and slender. Antennae very long and slender, longer than the half of the body. Pronotum cordiform (PW/PL: 0.91), widest at about the apical 5th. Base narrower than the anterior margin. Sides slightly sinuate before the base, which is rectilinear; sides very slightly curved to subrectilinear anteriorly; hind angles straight, evident, and upturned. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near 4/5 from the base; basal seta present, inserted before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra elongate and ovate, largest in the middle, slightly convex. Shoulders rounded, slightly evident, with the humeral border not continuing inwards. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible; juxtascutellar stria present but short and very slightly impressed; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; two setiferous pores on the third stria, the first one at the basal 4th, the second one in the middle. One preapical pore placed backwards and near to the 2nd stria. Aedeagus (Fig. 73) small (length 0.71 mm), long and stout, basal bulb small with a large sagit-



Figs 69-74. Habitus (69-72) and aedeagus in lateral view (73, 74) of *Goedetrechus* spp.: 69) *G. minutus* n. sp., HT ♀ from Niggly Cave; 70, 73) *G. rolani* n. sp., HT ♂ from Pendant Pot; 71, 74) *G. florentinus* n. sp., HT ♂ from Cauldron Pot; 72) *G. damperi* n. sp., HT ♀ from Damper Cave. Scale: 0.5 mm.

tal carina; median lobe, in lateral view, regularly curved from base to apex; apex short, stout, with the apical blade rounded. Inner sac unarmed. Parameres long and moderately slender, not reaching the apical 3rd of the median lobe, each one provided with 4 setae.

Etymology

We are glad to dedicate this new species to Rolan Eberhard who collected the first specimens.

Distribution and ecology

G. *rolani* sp. nov. is known from caves forming parts of the Growling Swallet- Junee Cavedrainage system in the Junee-Florentine karst: Growling Swallet Cave, Pendant Pot and Wherrets Cave in the northwestern portion of the system, and also from Threefortyone Cave (JF341) in the eastern end of the karst drainage system (Map 9). All known specimens of this species were collected in the deep areas of the caves.

Goedetrechus florentinus sp. nov.
(Figs 71, 74)

Loc. Typ.: Tasmania, Junee-Florentine, Cauldron Pot, 42°42'S 146°35'E.

Type series

HT ♂, Tas., 42°42'S 146°35'E, JF2-3, Junee-Florentine, Cauldron Pot, deep zone, 15.VII.1989, S. Eberhard leg. QVM 12: 43772 (QVML);

Diagnosis

A large-sized (5.06 mm) *Goedetrechus* of the *parallelus* group with an elongated pronotum, similar in this to *G. rolani* sp. nov.; it is well-differentiated from the latter by the head not macrocephalic, the shape of the pronotum, and the elitra with more parallel sides. It differs from *G. rolani* also for the median lobe of the aedeagus, in lateral view, with a decidedly smaller diameter.

Description of the HT ♂

Length mm 5.06. Body elongate (Fig. 71), with a small fore-body in comparison with the elytra, which are elongate and subparallel. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes. Metathoracic wings absent. Colour entirely testaceous. Head narrow. Clypeus convex at the base, with two apical setae on each side. Eyes reduced to a very small macula. Neck constriction evident. Labrum transverse, with a deeply emarginated apex; mandibles long and slender. Antennae very long and slender, longer than the half of the body. Pronotum cordiform (PW/PL: 0.90), widest at about the apical 4th. Base as wide as the anterior margin. Sides sinuate before the base, which is gently curved; sides very slightly curved to subrectilinear and angular anteriorly; hind angles straight, evident and upturned. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near the anterior 4th; basal seta present, inserted before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra elongate and subparallel, largest in the middle, slightly convex. Shoulders rounded slightly evident, with the humeral border not continuing inwards. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible; juxtascutellar stria present but short and very slightly impressed; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; two setiferous pores on the third stria, the first one at the basal 4th, the second one in the middle. One preapical pore placed backwards and near to the 2nd stria. Aedeagus (Fig. 74) small (length 0.69 mm), long and slender, basal bulb small with a large sagittal carina; median lobe, in lateral view, regularly curved from base to apex; apex short, stout, with the apical blade rounded. Inner sac apically provided with a large patch of sclerotized scales. Parameres long and moderately slender, not reaching the apical 3rd of the median lobe, each one provided with 4 setae.

Etymology

After the Florentine Valley near where the type locality is situated.

Distribution and ecology

G. florentinus sp. nov. is known only from the type locality, Cauldron Pot cave which forms part of the Growling Swallet- Junee Cavedrainage system in the Junee-Florentine karst in southern Tasmania (Map 9). The only known specimen of this species was collected in the deep area of the cave.

<<*G. mendumae* group>>

Diagnosis

A group of highly modified cave-dwelling species, eyeless, with very long antennae, and elytra with very obsolete humeri.

The following described species belong to this group:

G. mendumae Moore, 1972
G. damperi sp. nov.

Key to the species

1 Size bigger (mm 5.0-5.4); pronotum less cordiform; elytral humeri less rounded ..... *G. mendumae*
- Size smaller (mm 4.23); pronotum more cordiform; elytral humeri more rounded ..... *G. damperi* sp. nov.

Goedetrechus damperi sp. nov.
(Fig. 72)

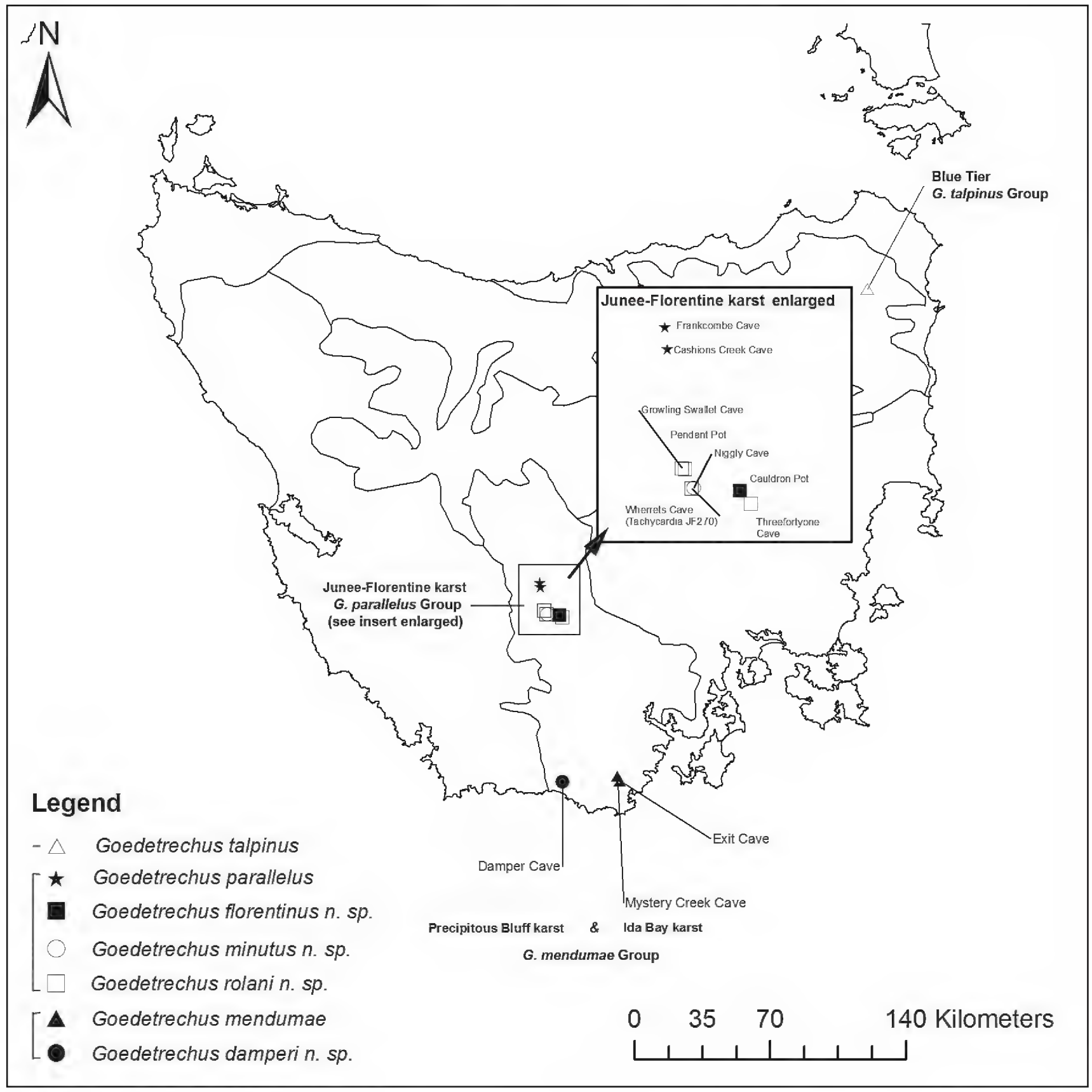
Loc. Typ.: Tasmania, Precipitous Bluff, Damper Cave, 43°27'51"S 146°36'51"E.

Type series

HT ♀, Tas., 43°27'51"S 146°36'51"E, PB1-1, Precipitous Bluff, Damper Cave, deep zone, streamway, 27.XII.1988, S. Eberhard leg. QVM 12: 43774 (QVML).

Diagnosis

A small-sized (4.23 mm) *Goedetrechus* of the *mendumae* group, with the pronotum elongated, more cordiform than in *G. mendumae*; it is well-differentiated from the latter, besides for the shape of the pronotum, for the elitra pyriform, with less obvious humeri.



Map 10 - Collection sites for *Goedetrechus* spp.

Description of the HT ♀

Length mm 4.23. Body elongate (Fig. 72), with a small fore-body in comparison with the elytra, which are elongate and pyriform. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes. Metathoracic wings absent. Colour entirely light testaceous. Head large. Moderately macrocephalous. Clypeus convex at the base, with two apical setae on each side. Eyes absent. Neck constriction evident. Labrum transverse, with a deeply emarginated apex; mandibles long and slender. Antennae very long and slender, as long as 3/4 of the body. Pronotum cordiform (PW/PL: 0.94), widest at about the apical 4th. Base narrower than the anterior margin. Sides strongly sinuate before the base, which is gently bisinuate; sides very slightly curved anteriorly; hind angles obtuse, evident and upturned. Front angles rounded and not advanced. Lateral margins narrow, widening posteriorly; anterior seta inserted near the anterior 5th; basal seta present, inserted just before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Elytra elongate and pyriform, largest in the middle, slightly convex. Shoulders obsolete, with the humeral border not continuing inwards. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible, but gently impressed; juxtascutellar stria present but short and very slightly impressed; apical recurrent striole long, gently curved, ending at the level of the 7th stria and with an apical carina. Chaetotaxis: juxtascutellar pore present; two setiferous pores on the third stria, the first one at the basal 4th, the second one just after the middle. One preapical pore placed backwards and near to the 2nd stria. Male unknown.

Etymology

After the type locality in Damper Cave.

Distribution and ecology

G. damperi sp. nov. is known only from the type locality, the Damper Cave, in the Precipitopus Bluff karst in the far south of Tasmania (Map 9). The only known specimen of this species was collected in the deep zone of the cave, on the cobble bed of a small stream.

Taxonomic comments

Within the genus *Goedetrechus* it is quite easy to identify, on a morphological basis, three distinct groups of species. The monospecific group of *T. talpinus* includes the typical species of forest litter, poorly depigmented, less specialized to life in the subterranean environment, characterized by a lesser ocular reduction and the pronotum less cordiform. This group includes a species morphologically well differentiated and geographically isolated in the NE of Tasmania (Blue Tier). The other two groups, respectively, of *G. parallelus* and *G. mendumae*, comprise species that are morphologically modified for subterranean life; depigmented, characterized by a more or less accentuated ocular reduction and the pronotum definitely cordiform. The two groups are geographically vicariant, the former is located in the Junee-Florentine area (central Tasmania), while the latter is located in the far south of the island. The group of *G. parallelus* includes *G. parallelus*, *G. rolani* sp. nov., *G. florentinus* sp. nov., and *G. minutus* sp. nov. These are all species morphologically less specialized and poorly differentiated from each other, indicating the phenomenon of a probably recent differentiation, but all four species are recorded from different caves within the Junee-Florentine karst, although some species are recorded from multiple caves, for example the range of *G. rolani* sp. nov. extends from caves in the Growling Swallet portion of this karst to caves in the Junee Ridge portion, but all these caves are hydrologically connected parts of the Growling Swallet-Junee Cave karst drainage system. *G. parallelus* is recorded from two caves (Frankcombes Cave and Cashions Creek Cave) (Moore 1972) in a more northern portion of the Junee-Florentine karst, which is not hydrologically connected to the former system. The group of *G. mendumae* includes *G. mendumae* and *G. damperi* sp. nov. These species are geographically vicariant, occurring in separate karst areas but both in far southern Tasmania. These species are morphologically more specialized but well differentiated from each other, indicating the phenomenon of a probably more ancient colonisation of subterranean environments The interesting zoogeographic possibility is that these three species groups, including species with a different degree of specialization, are the current outcome of heterochronic colonisation of the hypogean environment.

Genus *Trechistus* Moore, 1972

Type species: *Trechistus humicola* Moore, 1972

Trechistus Moore, 1972: 41.

Trechistus Moore: Casale & Laneyrie, 1982: 63.

Trechistus Moore: Moore et al, 1987: 130.

Trechistus Moore: Lorenz, 2005: 169.

Key to the species (from Moore, 1972 modified)

1 Elytra with pale maculae 2
- Elytra entirely dark ..... *T. incospicuus*
2 Pronotum cordate, the sides distinctly sinuate before the posterior angles ..... *T. stenoderus*
- Pronotum suborbicular, sides without sinuation 3
3 Pronotum largely pale, dark only on the disk ..... *T. sylvaticus*
- Pronotum largely dark, only the border pale 4
4 Smaller (length 3.5-4.0 mm); scutellar strioles missing; median lobe more arcuate ..... *T. terricola*
- Bigger (length 4.4-5.1 mm); scutellar strioles present or missing; median lobe more arcuate 5
5 Scutellar strioles present ..... *T. humicola*
- Scutellar strioles missing ..... *T. gordoni* sp. nov.

Trechistus terricola Moore, 1972

(Figs 75, 79)

Loc. Typ.: Hartz Mts. 3000 ft, Tas.

Trechistus terricola Moore, 1972: 42.

Trechistus terricola Moore: Casale & Laneyrie, 1982: 63.

Trechistus terricola Moore: Moore et al, 1987: 131.

Trechistus terricola Moore: Lorenz, 2005: 169.

Examined material

11 ♂♂ 10 ♀♀, Australia, Tas., Hartz Mts. N.P., Lake Osborne car park, m 900, 20.I.2002, rainforest, P.M. Giachino leg. (CGi); 1 ♀, Australia, Tas., Hartz Mts. N.P., Lake Osborne, m 900, 26.XI.1999, P.M. Giachino leg. (CGi);

Notes

The original description by Moore (1972) is sufficiently accurate and requires no additions, while we believe it is useful to provide drawings of habitus (Fig. 75) and aedeagus (Fig. 79).

Distribution and ecology

Until now known from the Hartz Mts. at a height of 3,000 ft and without further details of locality; it was collected by one of us (PMG) near Lake Osborne by sieving in a pocket of moist forest (Map 11).

Trechistus humicola Moore, 1972

(Figs 76, 80)

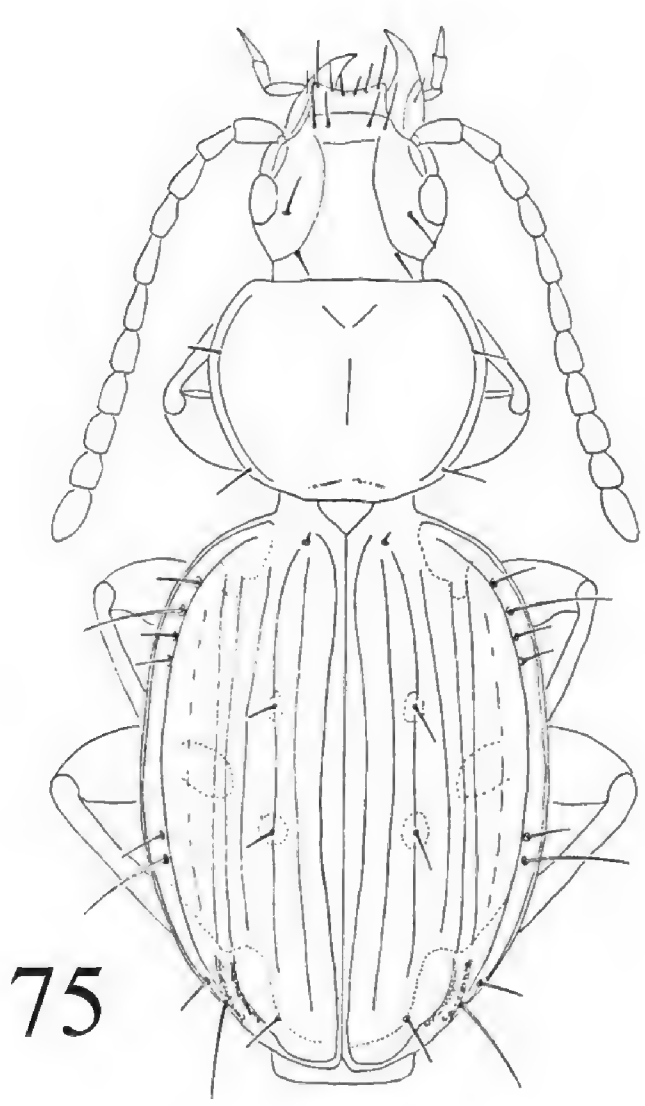
Loc. Typ.: Arve River, Hartz Mts. Natl. Park, Tas.

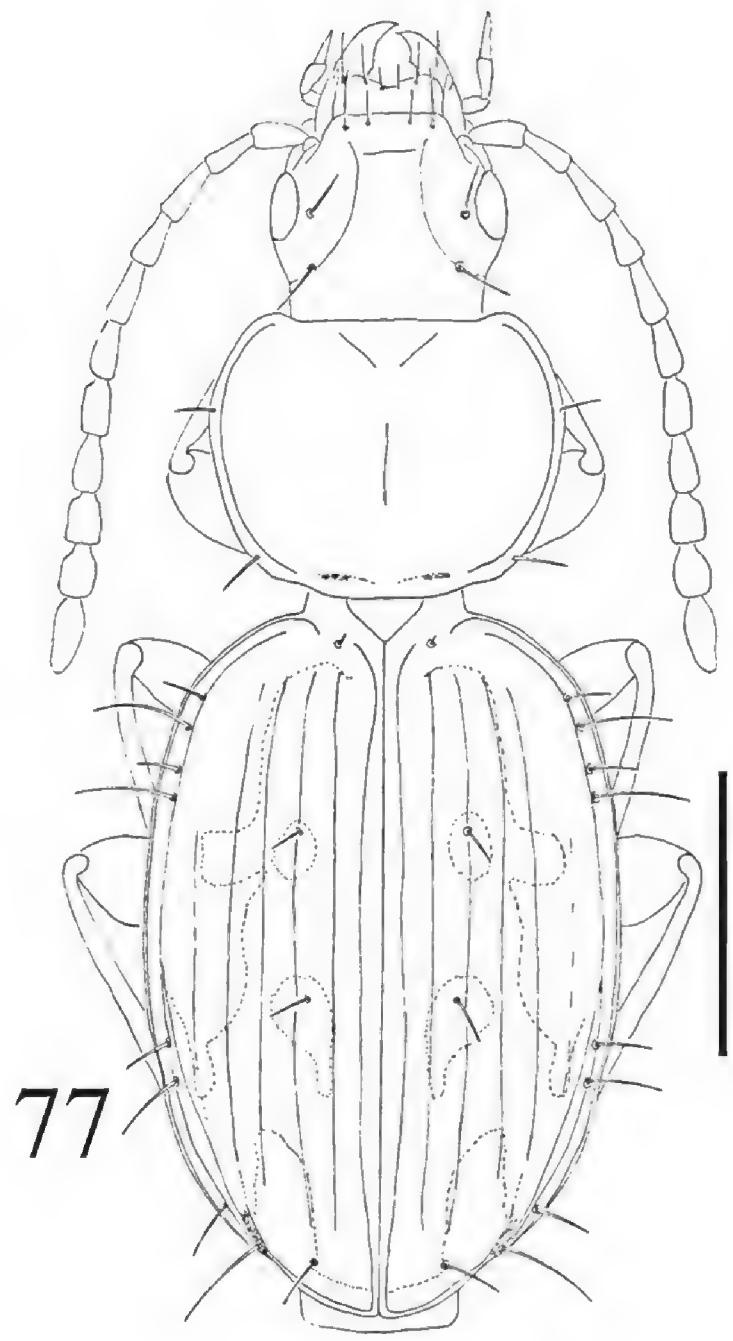
Trechistus humicola Moore, 1972: 41.

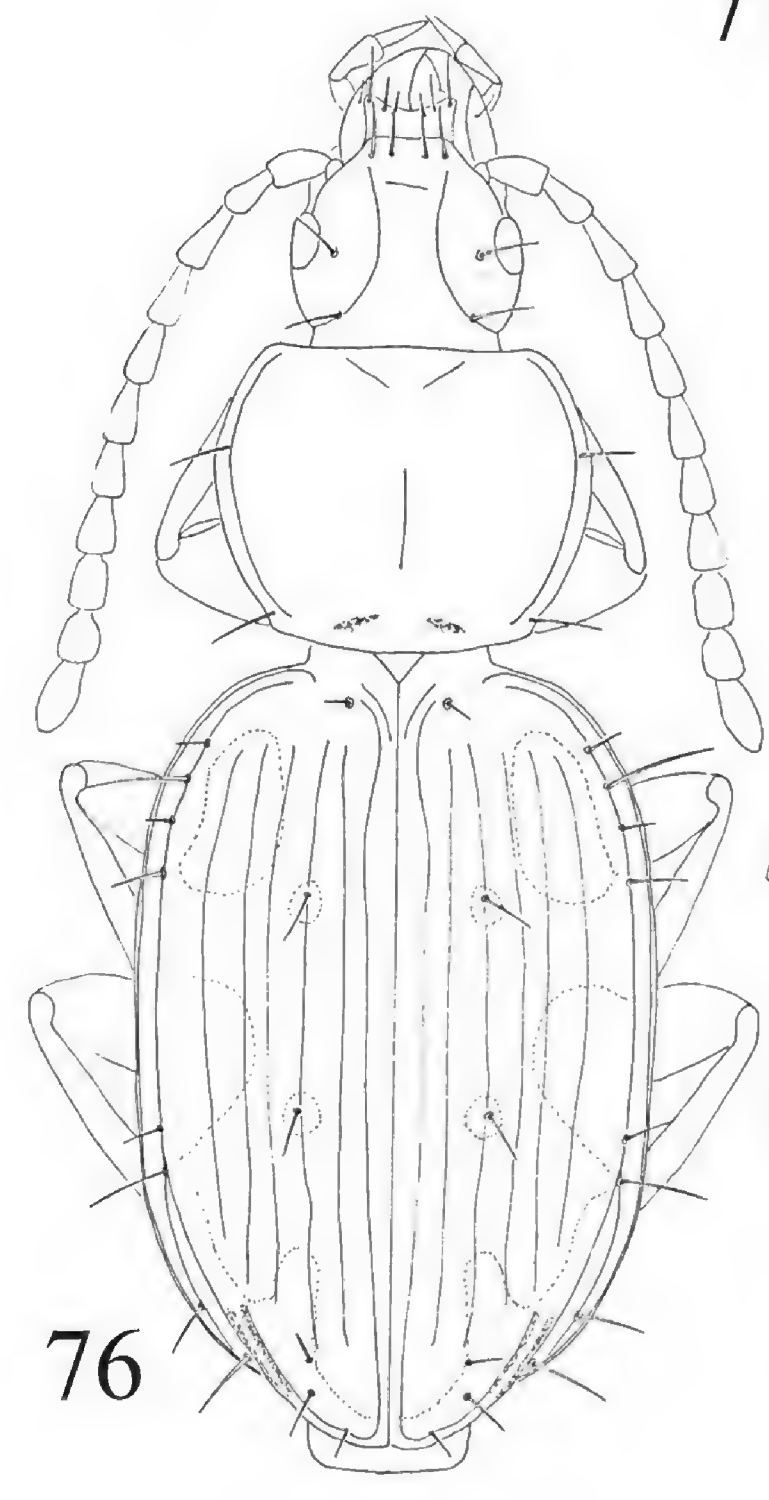
Trechistus humicola Moore: Casale & Laneyrie, 1982: 63.

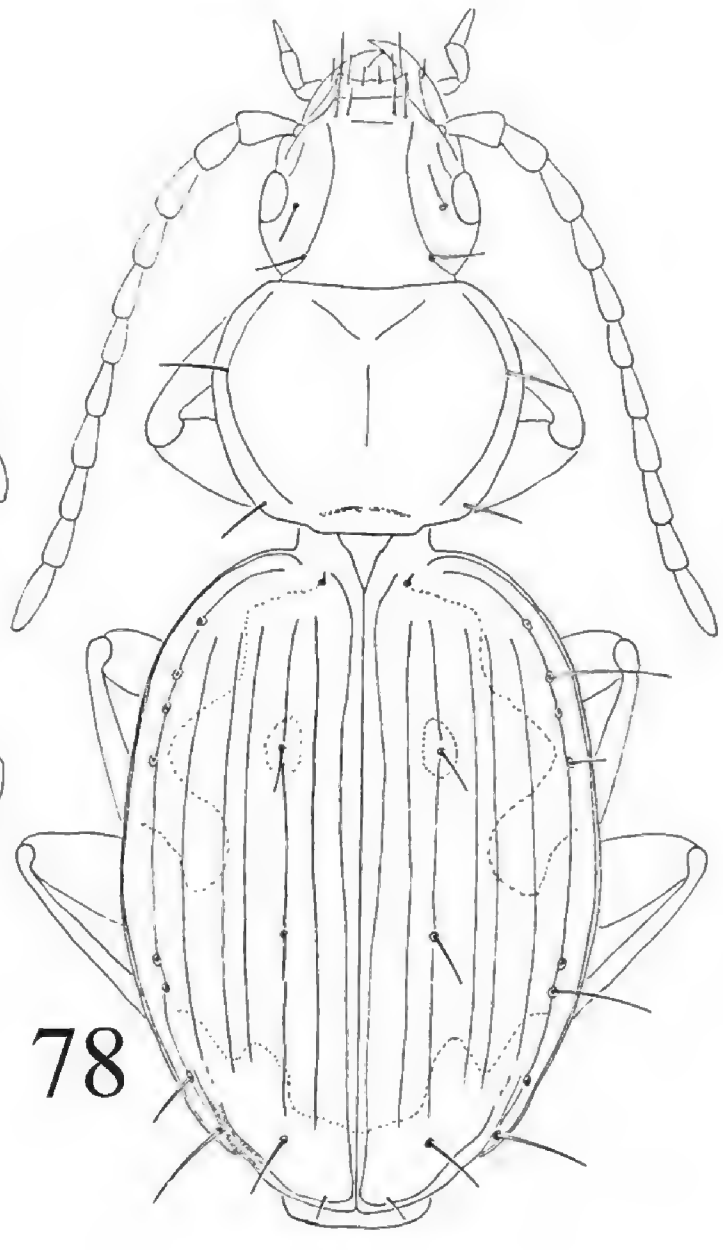
Trechistus humicola Moore: Moore et al, 1987: 130.

Trechistus humicola Moore: Lorenz, 2005: 169.









Figs 75-78. Habitus of *Trechistus* spp.: 75) *T. terricola* Moore, ♂ from Lake Osborne; 76) *T. humicola* Moore, ♂ from Mt. Wellington; 77) *T. gordoni* n. sp., HT ♂ from Creepy Crawly Walk; 78) *T. sylvaticus* Moore, ♂ from Capricorn Cave. Scale: 1 mm.

Examined material

1 ♀, Tas., 42°52'S 147°15'E, WE-X1-18, Mount Wellington, Mount Arthur Cave 1, leaf litter, 7.II.1989, Mark Nelson leg., QVM 12: 43784 (QVML); 1 ♀, Mt. Wellington, Tas., 7.12.53, C. Oke (MVM); 1 ♂, Mt. Wellington, Tas., 6.12.53, C. Oke (MVM); 1 ♂, Mt. Wellington, Tas., 4.10.54, C. Oke (CGi);

Notes

The original description by Moore (1972) is sufficiently accurate and requires no additions, while we believe it is useful to provide drawings of habitus (Fig. 76) and aedeagus (Fig. 80).

Distribution and ecology

Previously known from the Hartz Mts.; it was collected by one of us (SE) in a dolerite talus cave on Mt Arthur, a part of the Wellington Range near Hobart. At the same time we were able to examine two specimens collected on Mt. Wellington in the 1850s. These records extend significantly the known range of *T. humicola* (Map 11).

Trechistus gordoni sp. nov.
(Figs 77, 81)

Loc. Typ.: Tasmania, Gordon River Rd., Creepy Crawly Walk, m 565.

Type series

HT ♂, Australia, Tas., Gordon River Rd., Creepy Crawly Walk, m 565, 17.I.2002, P.M. Giachino leg. (QVML). PTT: 2 ♂♂ 5 ♀♀, Australia, Tas., Gordon River Rd., Creepy Crawly Walk, m 565, 17.I.2002, P.M. Giachino leg. (CGi); 2 ♀♀, Tas., 42°40'S 146°27'E, Junee-Florentine Windy Rift, Growling Swallet Cave, Glow worm chamber, JF36-8, 26.III.1989, S. Eberhard leg., QVM 12: 43783 (QVML).

Diagnosis

A large-sized (mm 4.55-4.80) *Trechistus*, similar in size, colour, shape od the pronotum and of the median lobe of the aedeagus to *T. humicola*. It is well-differentiated from the latter by the pronotum with completely curved sides before the basal angles, the different arrangement of elitral maculae, and the lack of juxtascutellar stria.

Description

Length mm 4.55- 4.60 ♂♂ 4.62-4.80 ♀♀. Body obovate (Fig. 77), with a relatively large fore-body in comparison with the elytra, which are short and ovate. Dorsal surface glabrous and shiny, with the microsculpture as transverse meshes and very slightly impressed on the elytra. Metathoracic wings absent. Colour largely dark reddish-brown, with pale maculae on elytra; head light reddish-brown. Lateral margins of the pronotum pale; elytra dark, with two pale humeral maculae extended postero-laterally to 2/3 of the elytral length; one pale, large and U shaped macula on the apical 4th, and 4 small maculae corresponding to the discal pores. Legs, antennomeres, and palpi testaceous. Head large. Clypeus convex at the base, with two apical setae on each side. Eyes large, convex, slightly prominent. Neck constriction evident. Labrum transverse, with a deeply emarginated apex; mandibles stout. Antennae short and slender, as long as the half of the body. Second antennal segment as long as the first one. Pronotum transverse (PW/PL: 1.25), widest at about 2/3 from the base. Base narrower than the anterior margin. Sides slightly curved before the base, which is bisinuate; hind angles obtuse and rounded. Front angles advanced. Lateral margins broad, widening posteriorly; anterior seta inserted at about the anterior 3rd; basal seta present, inserted before the angles. Basal foveae smooth, slightly impressed, rounded. Median line distinct. Discal surface gently convex. Male with two dilated protarsomeres. Elytra short, ovoid, widest in the middle, slightly convex. Shoulders rounded, with the humeral border continuing inwards to the level of the 3rd stria. Lateral border of the elytra wide and sharply narrowed backwards, ending in the slight preapical emargination. Elytral tip broad and rounded. Elytral disc with all striae visible; juxtascutellar stria absent; apical recurrent striole long, gently curved, ending at the level of the 6th stria and with a short apical carina. Chaetotaxis: juxtascutellar pore present; two setiferous pores on the third stria, respectively, at the basal 3rd, and just after the middle. One preapical pore placed backwards and closer to the 3rd stria. Aedeagus (Fig. 81) small (length 0.45 mm), stout; basal bulb small without a sagittal carina. Median lobe, in lateral view, gently curved and progressively reduced in diameter, with the apex short, stout and rounded. Inner sac apically provided with a small patch of sclerotized scales. Parameres long and moderately slender, reaching the apical 3rd of the median lobe, each one provided with 4 setae.

Etymology

After the Gordon Lake near which there is the type locality.

Distribution and ecology

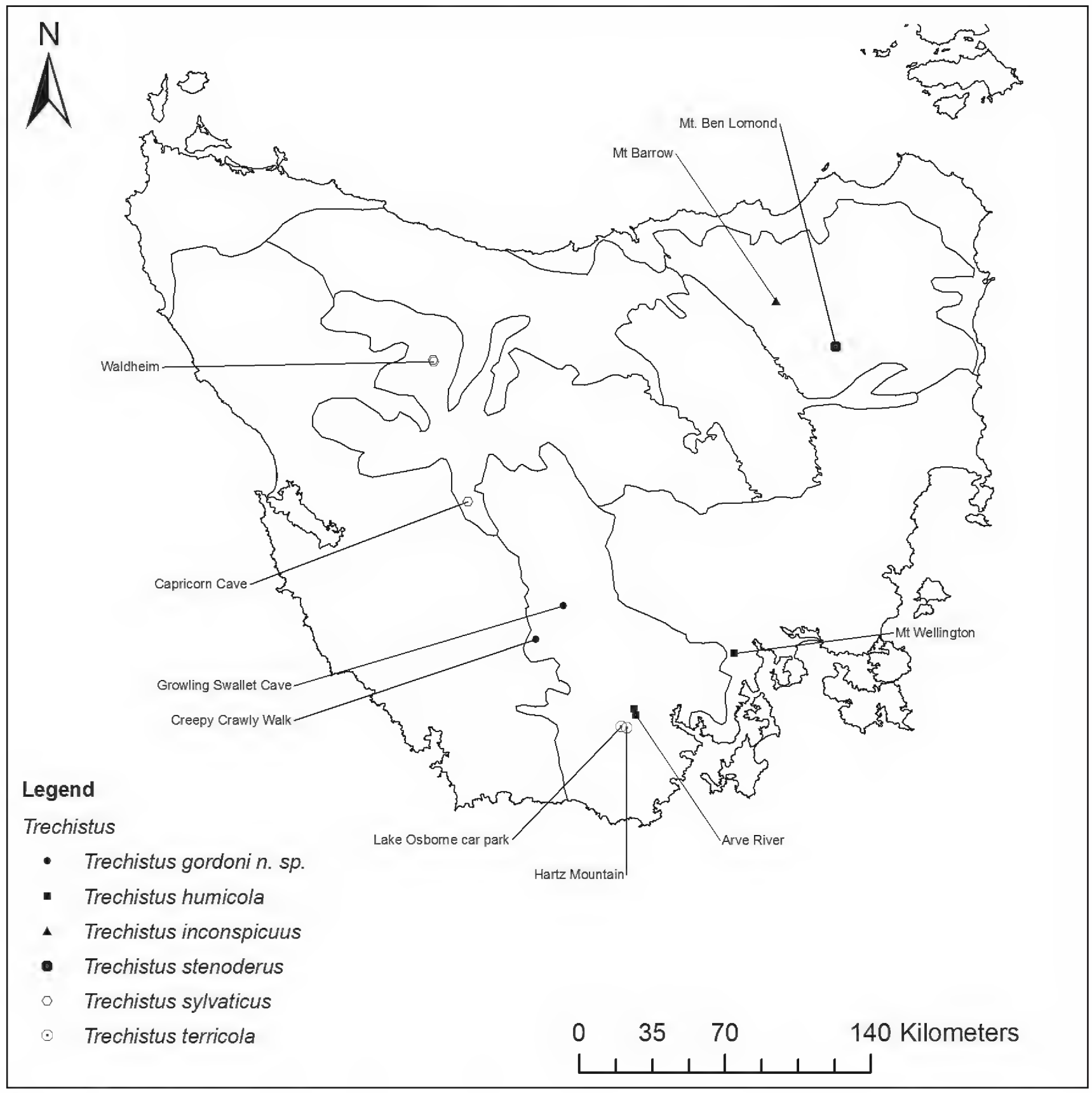
T. gordoni sp. nov. is currently known from two localities not much far from each other and both situated on the eastern edge of the Franklin-Gordon River National Park. In the first locality of Creepy Crawly Walk, located along the Gordon River Rd, this new species was collected by sieving rainforest litter at an altitude of 565 m a.s.l., and the second locality is Growling Swallet Cave of the Junee Florentine karst area, where it's occurrence underground is likely to be incidental (Map 11).

Trechistus sylvaticus Moore, 1972
(Figs 78, 82)

Loc. Typ.: Waldheim, 4000 ft, Tas.

Trechistus sylvaticus Moore, 1972: 42.

Trechistus sylvaticus Moore: Casale & Laneyrie, 1982: 63.



Map 11 - Collection sites for *Trechistus* spp.

Trechistus sylvaticus Moore: Moore et al, 1987: 131.
Trechistus sylvaticus Moore: Lorenz, 2005: 169.

Examined material

1 ♂ 1 ♀, Tas., 42°10'S 146°05'E, MR204-4 Mount Ronald Cross, Capricorn Cave, flood litter dark zone, 30.I.1989, S. Eberhard leg., QVM 12: 43782 (QVML, CGi);

Notes

The original description by Moore (1972) is sufficiently accurate and requires no additions, while we believe it is useful to provide drawings of habitus (Fig. 78) and aedeagus (Fig. 82).

Distribution and ecology

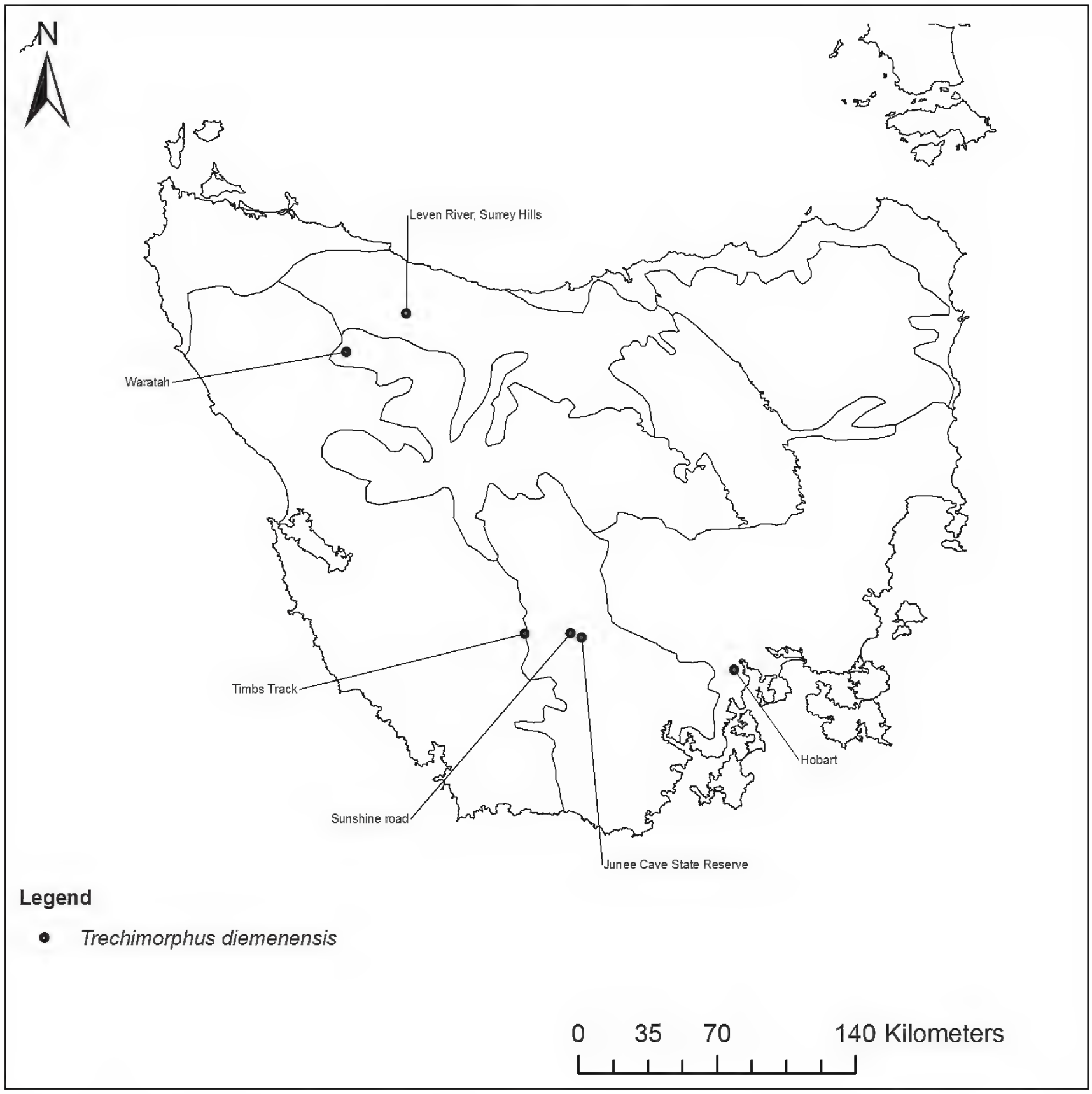
Previously known only from the type locality, the two non-troglomorphic specimens collected as incidental cavernicoles at Mount Ronald Cross, extend considerably southwards the known range of this species (Map 11).

Genus *Trechimorphus* Jeannel, 1927

Type species: *Trechus diemenensis* Bates, 1878.
Trechimorphus Jeannel, 1927: 79.
Trechimorphus Jeannel: Moore, 1972: 51.
Trechimorphus Jeannel: Casale & Laneyrie, 1982: 65.
Trechimorphus Jeannel: Moore et al, 1987: 133.
Trechimorphus Jeannel: Lorenz, 2005: 169

Trechimorphus diemenensis (Bates 1878)

Loc. Typ.: South or Central Tasmania.
Trechus diemenensis Bates, 1878: 322.
Trechimorphus diemenensis Bates: Jeannel: 1927: 81.
Trechimorphus diemenensis (Bates): Moore, 1972: 51.
Trechimorphus diemenensis (Bates): Casale & Laneyrie, 1982: 65.



Map 12 - Collection sites for *Trechimorphus diememensis.*

Trechimorphus diemenensis (Bates): Moore et al, 1987: 133.
Trechimorphus diemenensis (Bates): Lorenz, 2005: 169.

Examined material

1 ♂, Tas., 42°43'S 146°33'E, JFs 19, Junee-Florentine, Sunshine Road in rotting regrowth forest surface, 21.I.1990, S. Eberhard leg., QVM 12: 43786 (QVML); 2 ♂♂, Waratah, 13.3.40, E. Smith (MVM, CGi); 1 ♂, Hobart, 11.3.40, E. Smith (MVM); 1 ♀, Brigth, H.W. Davey (MVM); 3 ♂♂ 1 ♀, Australia, Tas., Maydena, Southwest N.P., Florentine Valley, Timbs Track, under bark, 5.XII.1998, P.M. Giachino leg. (CGi); 1 ♀ Australia, Tas. Hampshire, Companion Reserve, m 650, Leven River, Surrey Hills, 29.XI.1998, P.M. Giachino leg. (CGi); 1 ♂, Australia, Tas. Maydena, Junee Cave St. Res. m 300, 5.XII.1998, P.M. Giachino leg. (CGi).

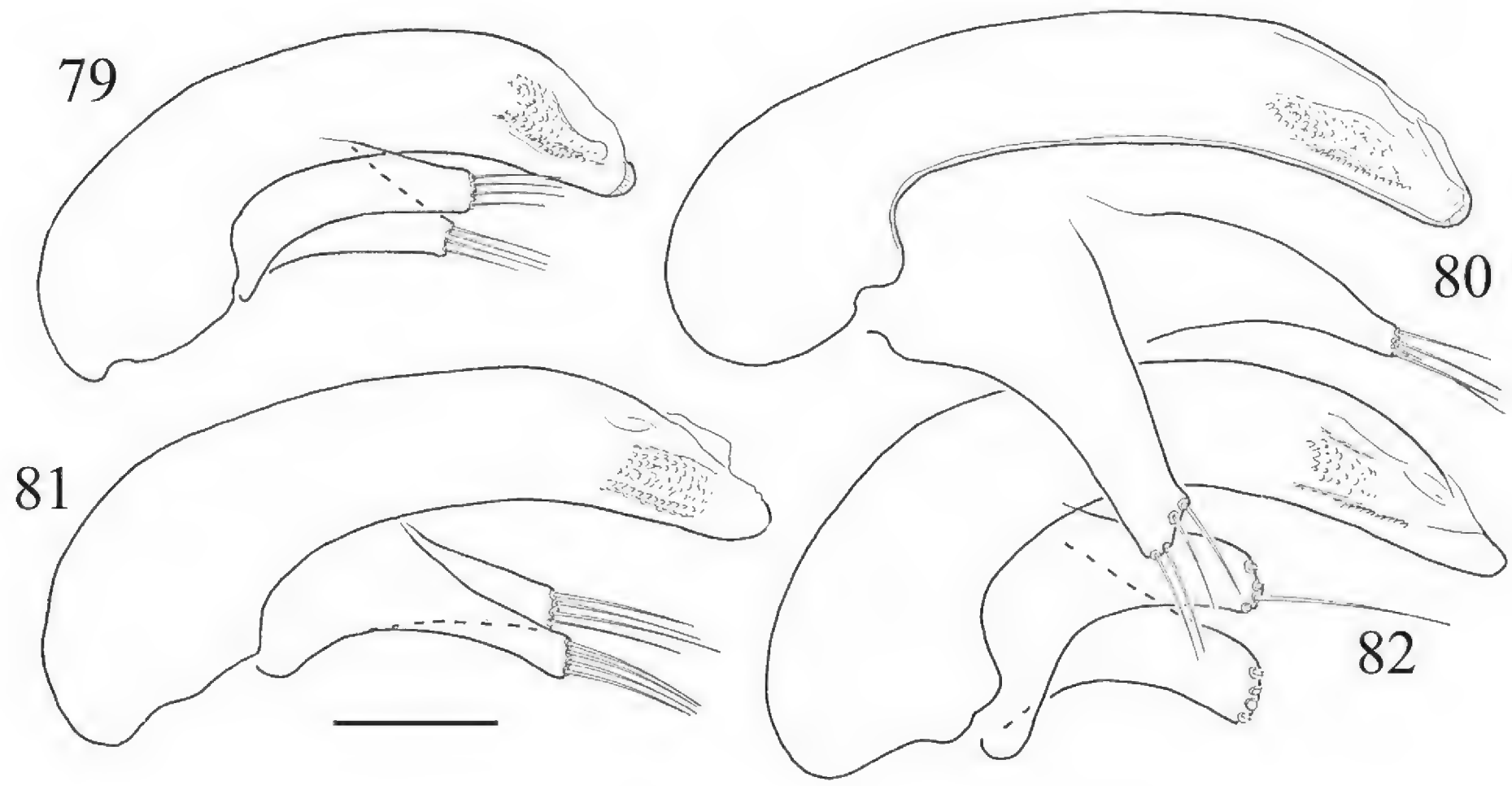
Distribution and ecology

This species is widely spread across Tasmania (Moore et al 1987) (Map 12).

Psydrinae LeConte, 1853
Psydrini LeConte, 1853

Genus *Mecyclothorax* Sharp, 1903

Type species: *Cyclothorax punctipennis* Macleay, 1871
Cyclothorax Macleay, 1871: 104.
Mecyclothorax Sharp, 1903: 243.
Mecyclothorax Sharp: Sloane, 1920: 153
Mecyclothorax Sharp: Moore, 1963: 286.
Mecyclothorax Sharp: Moore, 1984: 161.
Mecyclothorax Sharp: Moore et al, 1987: 147.
Mecyclothorax Sharp: Lorenz, 2005: 243.



Figs 79-82. Aedeagus in lateral view of *Trechistus* spp.: 79) *T. terricola* Moore, ♂ from Lake Osborne; 80) *T. humicola* Moore, ♂ from Mt. Wellington; 81) *T. gordoni* n. sp., HT ♂ from Creepy Crawly Walk; 82) *T. sylvaticus* Moore, ♂ from Capricorn Cave. Scale: 0.1 mm.

Mecyclothorax ambiguus (Erichson 1842)

Loc. Typ.: Tasmania.

Anchomenus ambiguus Erichson, 1842: 130
Mecyclothorax ambiguus Erichson: Sloane, 1920: 153
Mecyclothorax ambiguus (Erichson): Moore, 1984: 161.
Mecyclothorax ambiguus (Erichson): Moore et al, 1987: 147.
Mecyclothorax ambiguus (Erichson): Lorenz, 2005: 243.

Examined material

1 ♀, Tas., 43°27'S 146°36'E, PBs-3, Precipitous Bluff, New River Lagoon, surface litter in mixed forest, 1.I.1990, S. Eberhard leg., QVM 12: 43767 (QVML); 1 ♂ 1 ♀, Australia, Tas., Lake St. Clair N.P. m 740, 22.I.2002, P.M. Giachino leg. (CGi); 1 ♀, Australia, Tas., Lake St. Clair N.P. m 740, 29.XI.1998, P.M. Giachino leg. (CGi); 2 ♀♀, Australia, Tas., Great Lake, Miena, m 930, 8.XII.1998, P.M. Giachino leg. (CGi).

Distribution and ecology

According to Moore (1984) and Moore et al (1987) this species is present across Tasmania (Map 13).

Mecyclothorax punctipennis (Macleay 1971)

Loc. Typ.: Gayndah. Qld.

Cyclothorax punctipennis Macleay, 1871: 105.
Cyclothorax obsoletus Blackburn, 1889: 1389.
Mecyclothorax punctipennis (Macleay): Moore, 1984: 162.
Mecyclothorax punctipennis (Macleay): Moore et al, 1987: 149.
Mecyclothorax punctipennis (Macleay): Lorenz, 2005: 244.

Examined material

1 ♂ 1 ♀, Australia, Tas., Mt. Field N.P., Lake Dobson Rd., m 690, 16.I.2002, P.M. Giachino leg. (CGi).

Distribution and ecology

It was recorded by Moore (1984) and Moore et al (1987) in W.A., S.A., Vic., N.S.W., and Qld. This is the first record for Tasmania (Map 13).

Genus *Theprisa* Moore, 1963

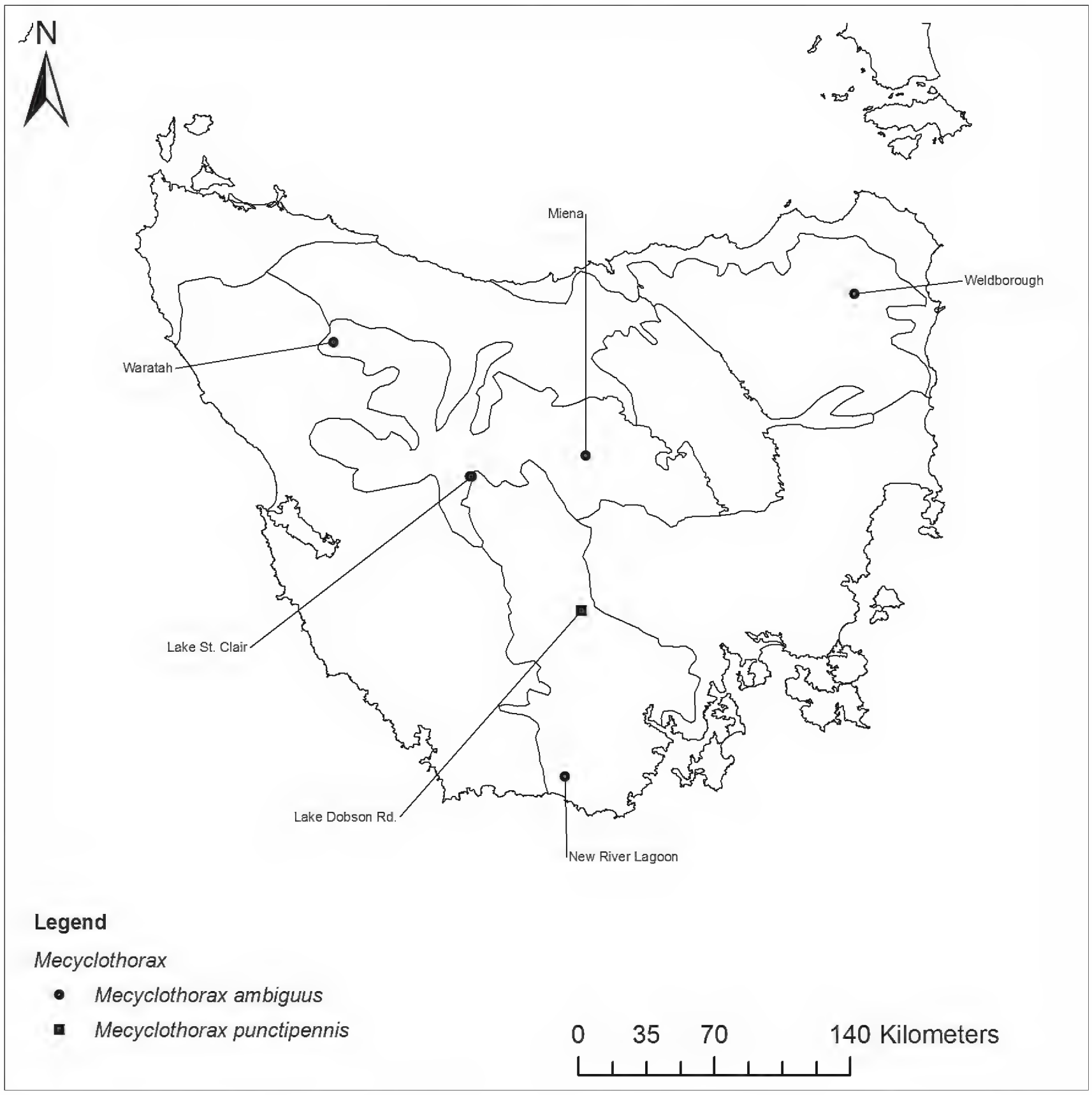
Type species: *Phersita convexa* Sloane, 1920.

Theprisa Moore, 1963: 285.
Theprisa Moore: Moore et al, 1987: 150.
Theprisa Moore: Lorenz, 2005: 245.

Theprisa convexa (Sloane 1920)

Loc. Typ.: Zeehan, Strahan and Waratah, Tas.

Phersita convexa Sloane, 1920: 158.
Theprisa convexa (Sloane): Moore, 1963: 285.
Theprisa convexa (Sloane): Moore et al, 1987: 150.
Theprisa convexa (Sloane): Lorenz, 2005: 245.



Map 13 - Collection sites for *Mecyclothorax* spp.

Examined material

1 ♂, Tas., 42°40'S 146°27'E, Junee-Florentine Windy Rift, Growling Swallet Cave, 26.III.1989, S. Eberhard leg., QVM 12: 43766 (QVML); 1 ♀, Tasmania, Waratah (CGi); 2 ♂♂ 1 ♀ Australia, Tas. Hampshire, Companion Reserve, m 550, Emu River (rainforest), 29.XI.1998, P.M. Giachino leg. (CGi); 1 ♂ Australia, Tas. Hampshire, Companion Reserve, m 600, S. Valentine Peak (rainforest), 29.XI.1998, P.M. Giachino leg. (CGi); 1 ♂ Australia, Tas. Tewkesbury m 600, 1.XII.1998, P.M. Giachino leg. (CGi); 1 ♂, Australia, Tas., Maydena, Southwest N.P., Florentine Valley, Timbs Track, m 500, 5.XII.1998, P.M. Giachino leg. (CGi); 1 ♀, Australia, Tas., Murchison Hwy., Hellyer Gorge St. Res., Hellyer River Picnic Area, 30.I.2002, P. M. Giachino leg. (CGi).

Distribution and ecology

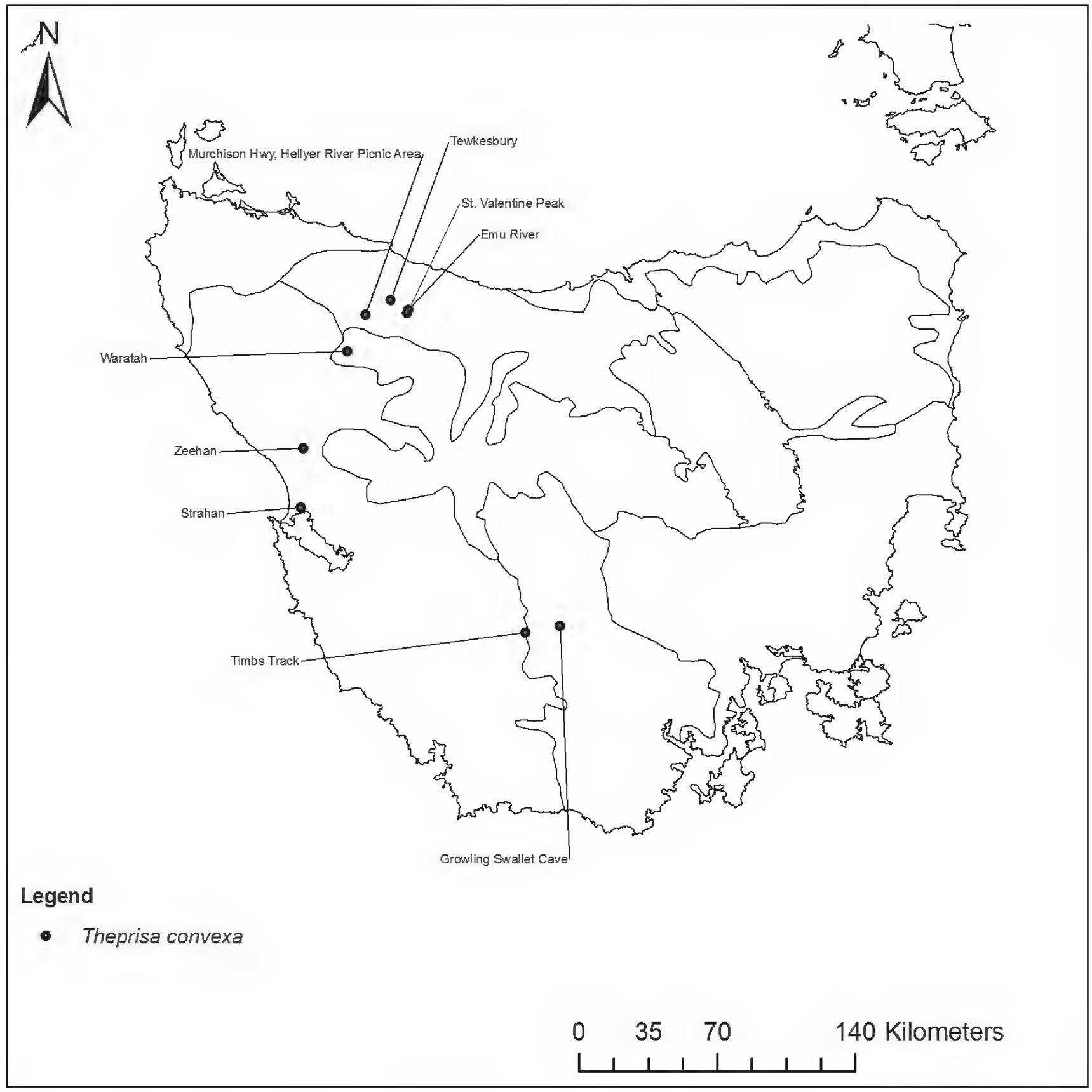
The new localities expand slightly east and southwards the range of this species (Map 14). The single record of this species in a cave must be considered incidental.

Genus *Pterogmus* Sloane, 1920

Type species: *Pterogmus rufipes* Sloane, 1920.
Pterogmus Sloane, 1920: 155.
Pterogmus Sloane: Moore, 1963: 282.
Pterogmus Sloane: Moore et al, 1987: 151.
Pterogmus Sloane: Lorenz, 2005: 245.

Pterogmus rufipes Sloane, 1920

Loc. Typ.: Ben Lomond and Waratah.
Pterogmus rufipes Sloane, 1920: 156.



Map 14 - Collection sites for *Theprisa convexa.*

Pterogmus rufipes Sloane: Moore, 1963: 282.
Pterogmus rufipes Sloane: Moore et al, 1987: 151.
Pterogmus rufipes Sloane: Lorenz, 2005: 245.

Examined material

3 ♀♀, Australia, Tas., Gordon River Rd., Florentine Valley, Timbs Track, m 460, 17.I.2002, P.M. Giachino leg. (CGi).

Distribution and ecology

The new locality expands southwards the range of this species (Map 15). The specimens examined were collected by sieving litter in rainforest.

Genus *Amblytelus* Erichson, 1842

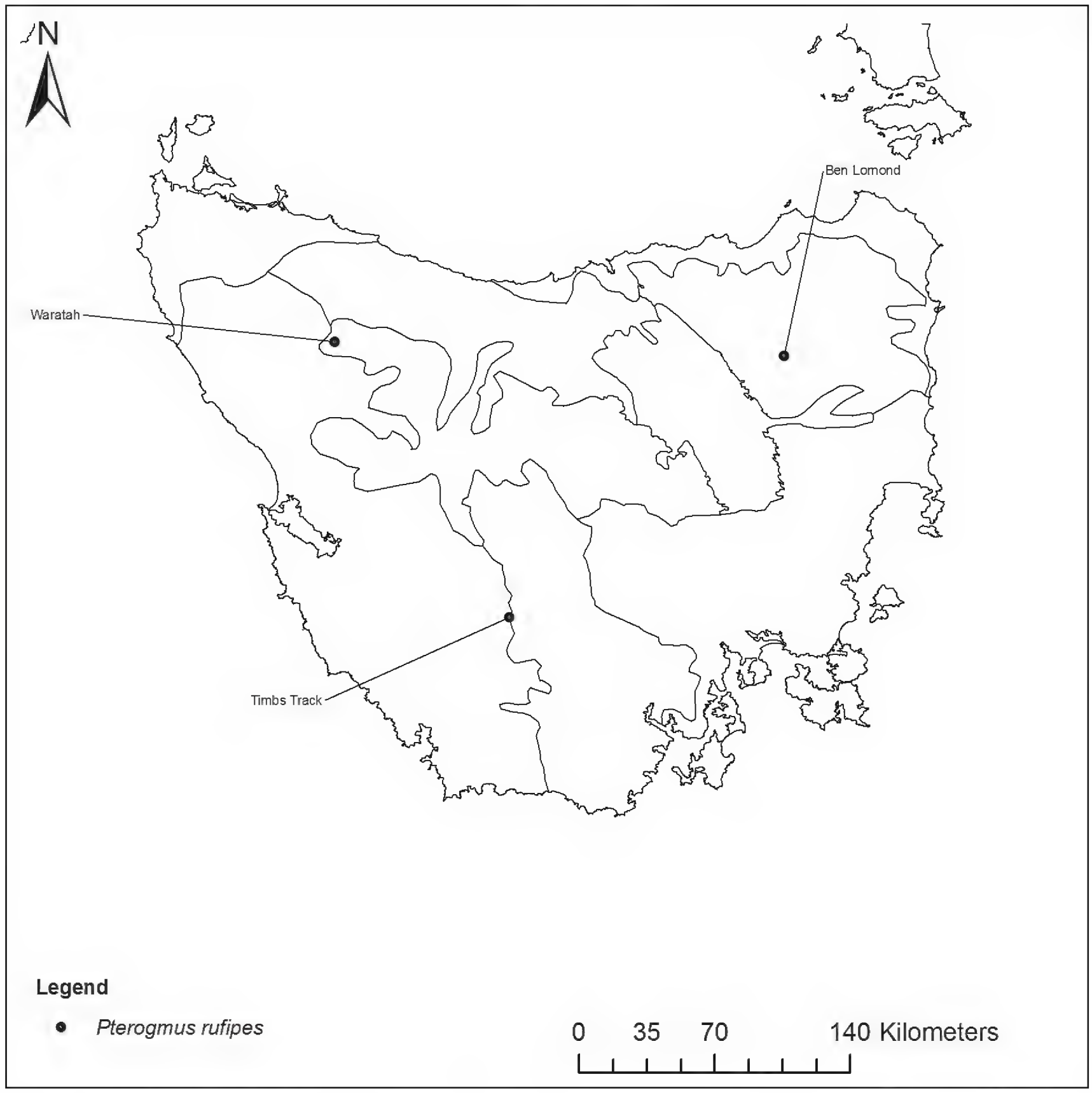
Type species: *Carabus curtus* Fabricius, 1801.
Amblytelus Erichson, 1842: 129.
Amblytelus Erichson: Sloane, 1920: 153.
Amblytelus Erichson: Moore, 1963: 279.
Amblytelus Erichson: Moore et al, 1987: 154.
Amblytelus Erichson: Baehr, 2005: 27.
Amblytelus Erichson: Lorenz, 2005: 245.

Amblytelus niger Sloane, 1920

Loc. Typ.: Mt. Wellington, Tas.
Amblytelus niger Sloane, 1920: 154.
Amblytelus niger Sloane: Csiki, 1929: 492.
Amblytelus niger Sloane: Moore et al, 1987: 155.
Amblytelus niger Sloane: Baehr, 2005: 54.
Amblytelus niger Sloane: Lorenz, 2005: 246.

Examined material

1 ♂, Australia, Tas., Hobart, Mt. Wellington, m 1200, 19.I.2002, P.M. Giachino leg. (CGi).



Map 15 - Collection sites for *Pterogmus rufipes*.

Distribution and ecology

The specimen examined was collected by sieving litter beneath bushes on the top plateau of Mt. Welllington (Map 16).

Amblytelus montiscampi Baehr, 2005

Amblytelus montiscampi Baehr: Lorenz, 2005:246.

Examined material

1 ♂, Australia, Tas., Cradle Mt. N.P., Lake Dove, Marions Lookout, m 1100, 30.XI.1998, P.M. Giachino leg. (CGi).

Distribution and ecology

The specimen examined was collected by sieving litter beneath bushes at 1100 m a.s.l.

Genus *Dystrichothorax* Blackburn, 1892

Type species: *Amblytelus amplipennis* Macleay, 1871.

Dystrichothorax Blackburn, 1892: 88.
Dystrichothorax Blackburn: Sloane, 1920: 153.
Dystrichothorax Blackburn: Moore, 1963: 279.
Dystrichothorax Blackburn: Moore et al, 1987: 156.
Dystrichothorax Blackburn: Baehr, 2005: 128
Dystrichothorax Blackburn: Lorenz, 2005: 246.

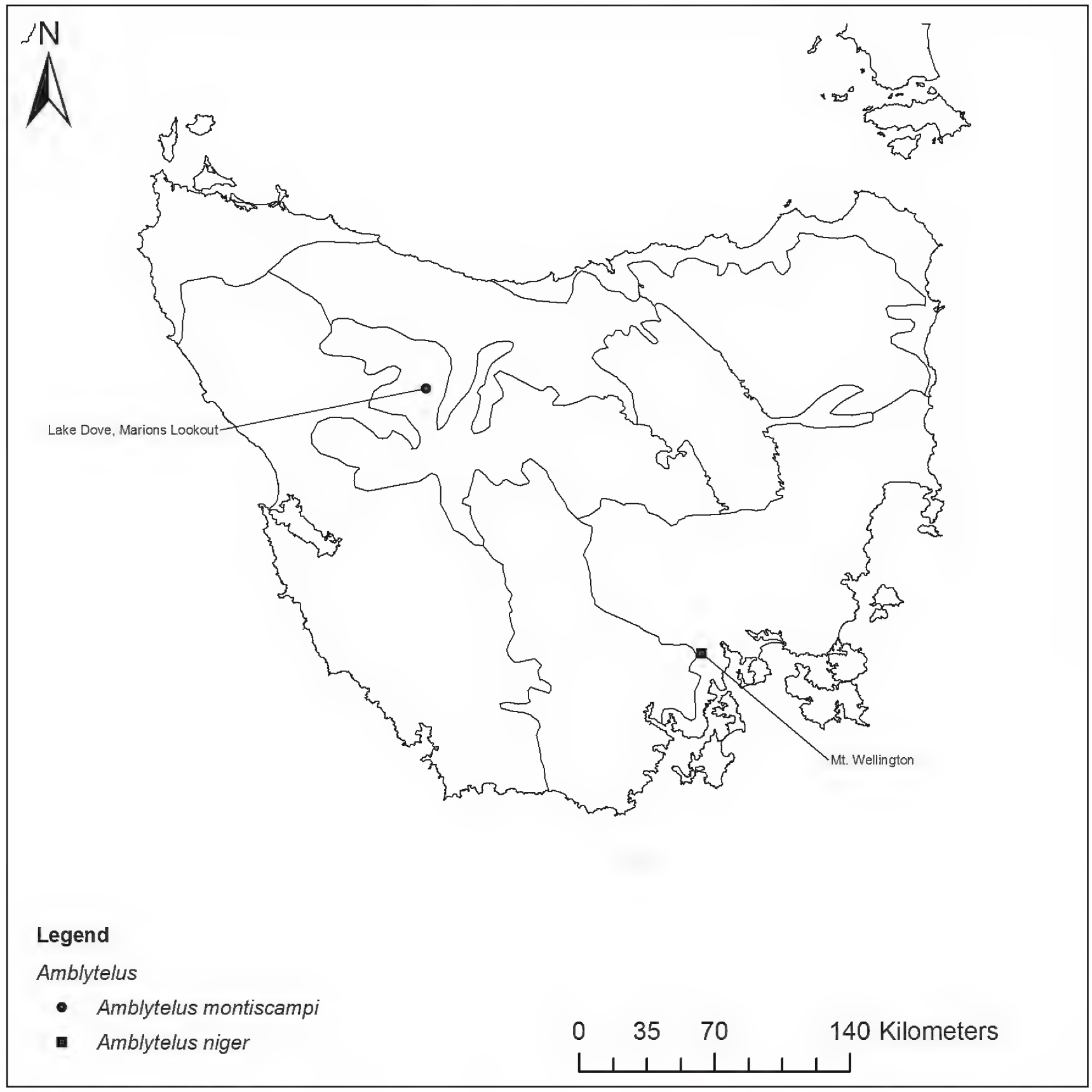
Dystrichothorax tasmaniensis Baehr, 2005

Loc. Typ.: Tas., Pirates Rd. Tasman Peninsula

Dystrichothorax tasmaniensis Baehr, 2005: 200.
Dystrichothorax tasmaniensis Baehr: Lorenz, 2005: 246.

Examined material

1 ♂, Australia, Tas., South Arthur Forest, Rapid Rd., Rapid River, 29.I.2002, P. M. Giachino leg. (CGi); 1 ♀,



Map 16 - Collection sites for *Amblytelus* spp.

Australia, Tas., Hartz Mts. N.P., Lake Osborne, m 1000, 20.I.2002, M. Daccordi leg. (CGi).

Distribution and ecology

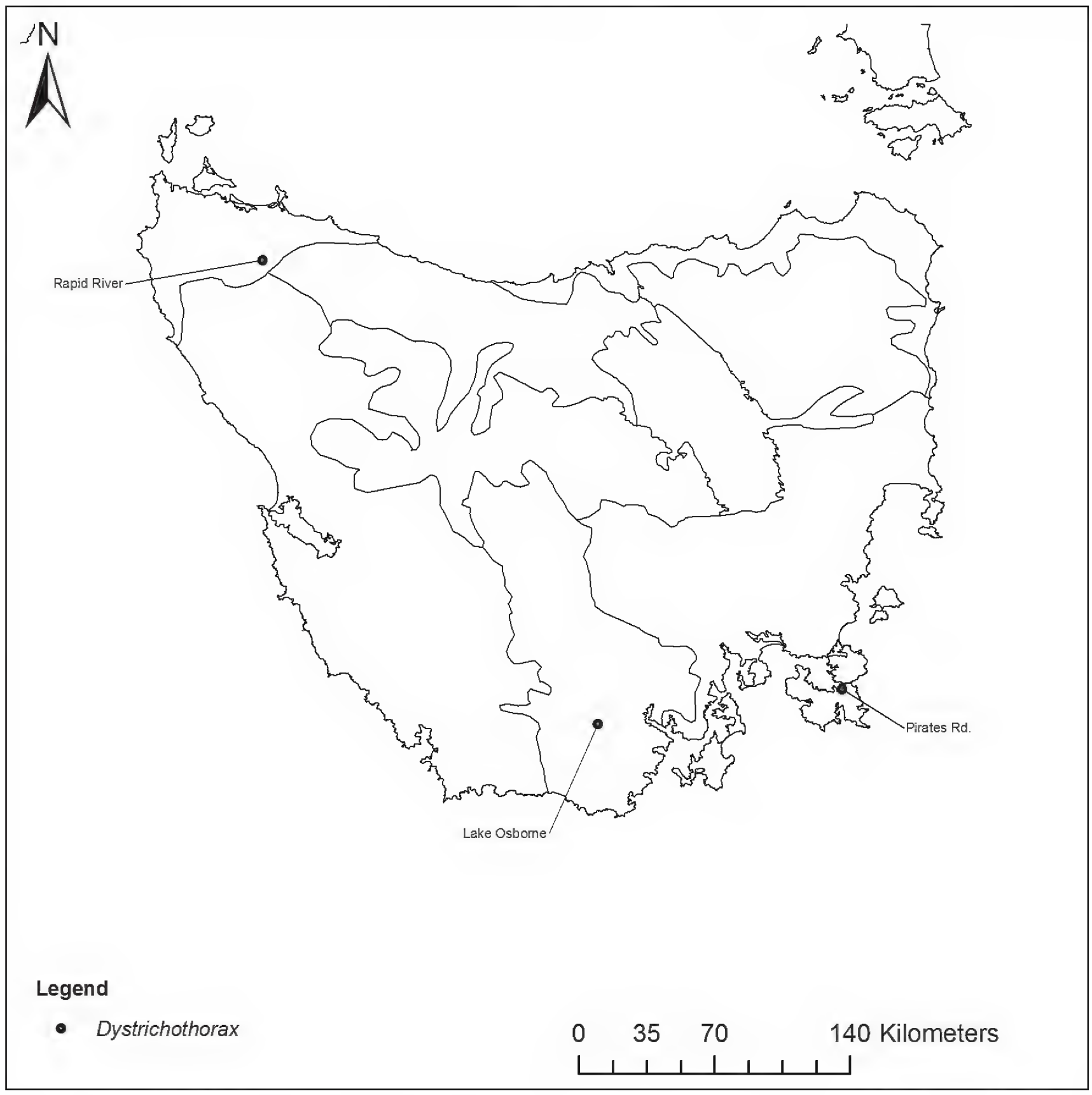
According to Baehr (2005) this species is widely distributed in Tasmania (Map 17).

DISCUSSION

Survey coverage

To evaluate the curent state of knowledge of Tasmanian Carabidae from a biogeographic perspective, we combined our collection records with the published literature records (110 records, 60 species) of Jeannel (1927), Donabauer (2001), Moore (1963, 1972, 1978, 1983, 1984, 1994), and a few additional records in Eberhard et al (1991) and Eberhard (1999, 2000, 2001a, 2001b), and mapped these in relation to the Interim Biogeographic Regionalization for Australia (IBRA) version 6.1 (2004) (Map 18). IBRA regions represent a landscape based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. While it is inevitable that much collected carabid material exists in non-museum collections and/or unpublished reports not readily available for incorporation herein, Map 18 suffices to give an indication of existing survey coverage and major knowledge gaps. Not unexpectedly, geographic survey coverage is quite patchy and large areas have no published records, although this paper makes substantial new contributions to filling geographic and taxonomic knowledge gaps in the West, Central Highlands, Ben Lomond, Northern Slopes and Southern Ranges IBRA regions, including karst areas.

The entire survey effort (published literature and this manuscript) and diversity recorded across IBRA regions is summarised in Table 1. Overall, 196 published records of 83 species in 21 genera were recorded from 41 locali-

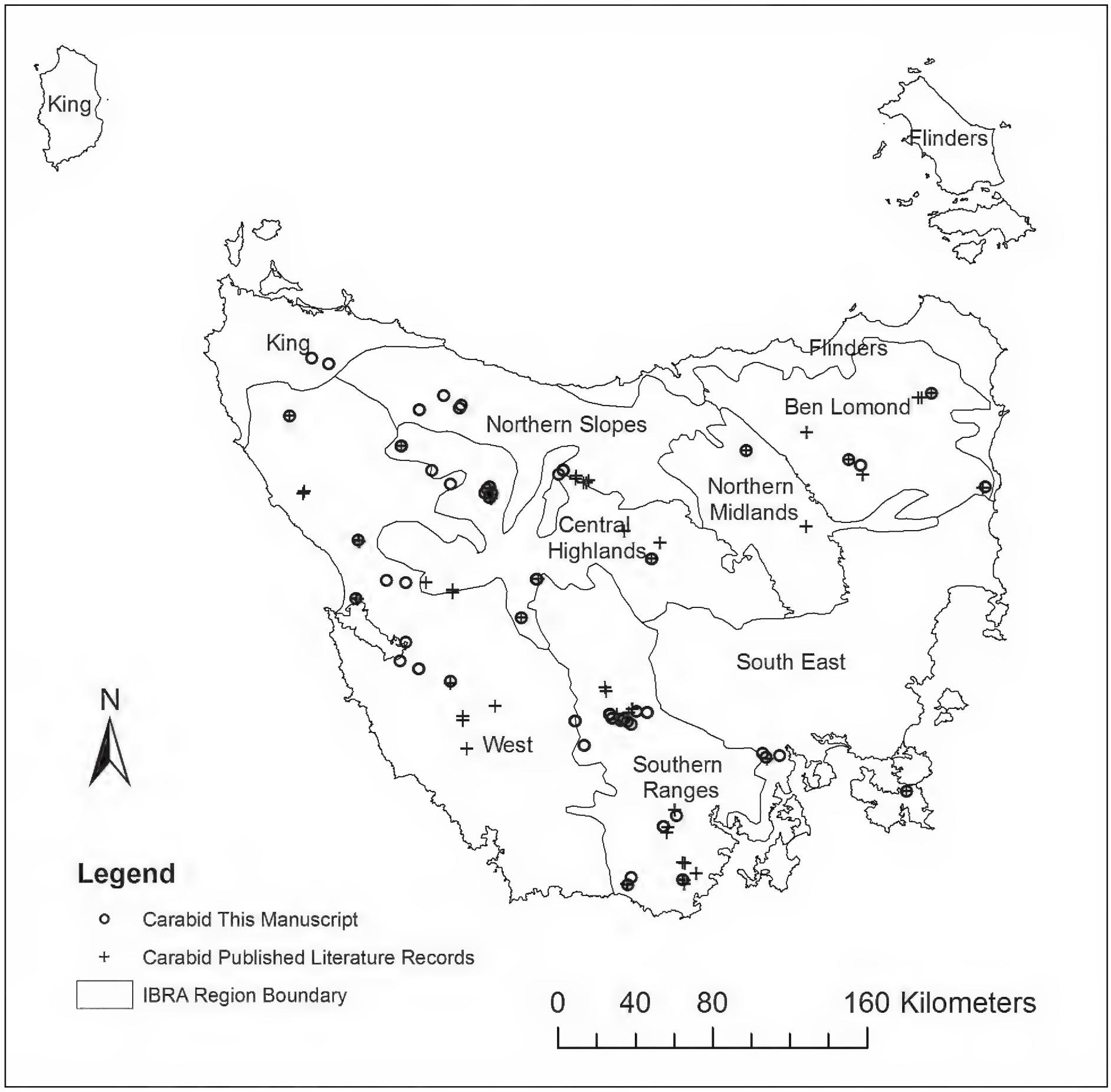


Map 17 - Collection sites for *Dystrichothorax tasmaniensis.*

ties (including 11 karst areas). In all IBRA regions, survey efforts have generally been focused at just a few localities subjected to repeated visits by different collectors over the years, and no IBRA region has more than ten sampled localities (Table 1, Map 18). Not surprisingly, there is a relationship between collection records and recorded diversity, the Central Highlands (31 species) and Southern Ranges (32) have received the most attention and have the highest recorded diversity. The next richest regions are West (18 species) and Ben Lomond (14).

Three IBRA regions clearly stand out as either, unsurveyed (Flinders), or poorly surveyed (South East and Northern Midlands). These three regions are characterised, physiographically, by lower average altitude and effective precipitation, and as a consequence more generally support dry (versus wet) forest types. From an anthropogenic perspective, these regions have also been more impacted by land-clearing and ruralisation. With due consideration to physiographic and anthropogenic factors we consider that the observed patterns also reflect an historical artefact of surveyor preferences towards renowned and publically more accessible locations such as roadsides and National Parks.

Tasmania is well endowed with karst and caves, which are developed predominantly in Ordovician limestones and Precambrian dolomites (Map 19). Some 300 discrete karst areas and more than 1,000 caves ranging up to about 15 kilometres in length and 375 metres in depth are recorded (Kiernan 1995). A diverse terrestrial cave fauna has been documented (Eberhard 2001a) although only a small proportion of the known caves (estimated less than 20%) and karst areas (about 10%) have been biologically investigated with only a handful of these subject to repeated sampling, most notably at Mole Creek, Bubs Hill, Ida Bay, Hastings, Precipitous Bluff and Junee-Florentine (Eberhard et al 1991). Major areas



Map 18 - Tasmania's Biogeographic Regions (IBRA) and Carabidae distribution records distinguishing collection records first appearing in this paper ("O") and previous published literature records (" +"). IBRA version 6.1 (2004) Commonwealth of Australia.

of Tasmanian karst have never been surveyed, or only cursorily surveyed, notably in NW Tasmania, King Island, Flinders Island, West and Southern Ranges.

For subterranean carabids, the observed distribution patterns are predominantly controlled by the distribution of cavernous karstic rocks, these being poorly represented in the South East, Northern Midlands and Flinders IBRA regions (Map 19). Nonetheless, the occurrence of troglomorphic species in the geo-physiographically distinct and isolated Gray karst area in eastern Tasmania indicates that surveys for carabids in moist refugial habitats of drier eastern and northern Tasmania may be fruitful.

There has been little searching for subterranean beetles in non-karstic rocks or meso-cavernous habitats, but in other parts of the world diverse troglobitic faunas have been recorded from Superficial (or Shallow) Subterranean Habitat (SSH) (*sensu* Howarth 1983; Giachino and Vailati 2010; Culver and Pipan 2009) or Milieu Superficial Souterrain (MSS, *sensu* Juberthie 1984). This SSH / MSS fauna was originally described from North Temperate montane (peri-) glaciated regions of continental Europe (Giachino & Vailati 2010), and subsequently in North Tropical arid oceanic island environments (Oromi and Martin 1992). In Tasmania, a cave invertebrate community comprising troglophiles (including *P. striatulus*) and troglobitic arachnids (Opiliones), is recorded from caves formed in dolerite talus at 1100 m altitude on Mount Wellington (Eberhard 2001a; Eberhard et al

Table 1 - Survey effort and recorded diversity by IBRA region arranged in order of increased survey effort. Survey effort measured by number of sampled localities and collection records; diversity represented by number of described genera and species. Karst localities and cave records / troglobitic taxa shown in brackets "( )".

	Survey Effort		Recorded Diversity	
IBRA Region	**Sampled Localities (karst)**	**Collection Records (cave)**	**No. Genera (troglobites)**	**No. Species (troglobites)**
Flinders	0			
Northern Midlands	2	2	2	2
King	2	3	3	3
South East	3	7	6	7
Northern Slopes	4 (1)	16 (9)	4 (1)	6 (3)
Ben Lomond	5 (1)	21 (3)	8 (1)	14 (1)
West	10 (3)	26 (5)	9 (2)	18 (2)
Central Highlands	6 (2)	57 (2)	16 (2)	31 (2)
Southern Ranges	10 (4)	64 (25)	13 (2)	32 (8)
Total	**41 (11)**	**196 (44)**	**21 (5)**	**83 (17)**

1991). Dolerite boulder fields and talus slopes of glacial - periglacial origins, and deeply fissured cliffs, are common and well-developed in mountainous areas of Tasmania, and we predict that these SSH / MSS habitats will be prospective for diverse troglobitic faunas, including Carabidae.

Diversity

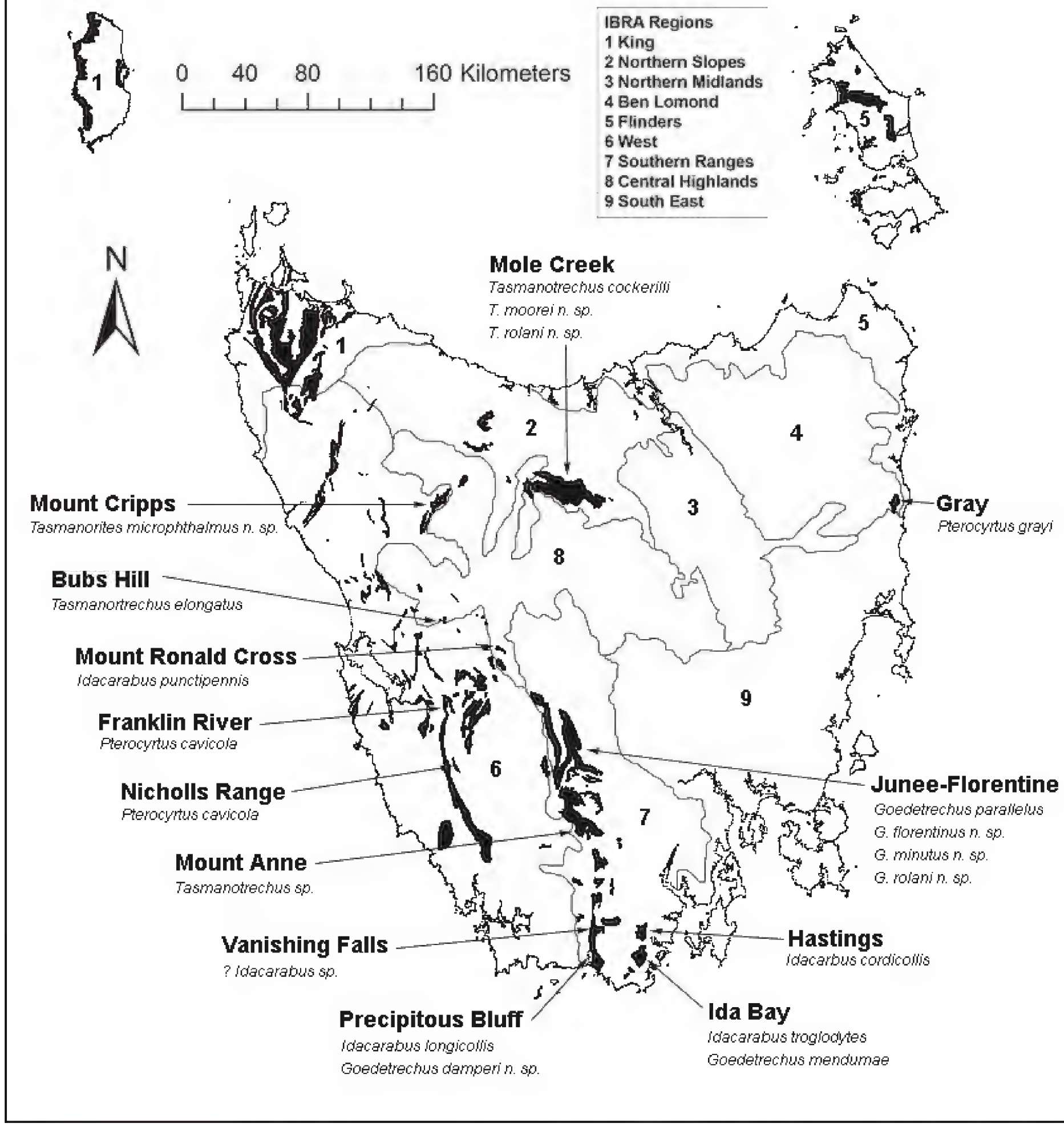
This study has made a significant contribution towards further recording and describing the remarkably rich ground beetle fauna of Tasmania. The fauna includes a significant proportion (about 50 %) of species endemic to Tasmania, and, an interesting suite of specialized subterranean forms exhibiting various degrees of troglomorphy, and which display highly localised distribution patterns. A systematic checklist of all described Tasmanian Trechinae (excluding Bembidiini) and treated Psydrinae is presented in Table 2.

The taxonomic body of this paper details 109 collection sites for 59 species in 17 genera. Eighty-eight (88) of these collection records, mostly made by the authors, are published here for the first time, and as such represent the most comprenhensive contribution since Moore's (1972) major treatise. Of our records detailed herein, 63 pertain to previously described species, for which new localities and some significant extensions of distribution range, altitude, and habitat are documented. Eighteen new species are described, comprising eleven epigean species collected in forest, montane and alpine habitats across southern, western and northern Tasmania, in addition to seven obligate hypogean species (troglobites) collected from caves in five discrete karst areas. Eight previously described species belonging to four trechine genera were not detected or rexamined during our surveys: *Mimanillus gracilis* (Moore 1972), *Mimotrechus carteri* (Sloane), *Paratrechodes macleayi* (Sloane), and *Pogonoschema* spp. (Table 2).

To evaluate local (versus regional) diversity and identify potential 'hotspots' we examined the collection records at several localities which have been popular with collectors over many years (Table 3). The most well-sampled, and diverse, localities are Cradle Mountain (18 species), Lake St Clair (11) and Waratah (11) in the Central Highlands region, and Junee-Florentine (11), Mount Field (8), and Hartz Mountains (11) in the Southern Ranges region. The mountains in NE Tasmania have also received repeated attention, namely Blue Tier (6 species), Ben Lomond (4) and Mount Barrow (4). Cradle Mountain stands out as a hotspot for carabid beetles; however it has probably received the most intensive survey efforts, which also span a range of altitudinal and vegetation environments extending from montane forest to alpine herbfields. At Cradle Mountain, and other localities, one sieve sample of leaf litter may contain up to five species of Trechini, including multiple congeneric species. In karst areas, the Junee-Florentine has the highest diversity of troglobitic carabids with four species of *Goedetrechus* currently described, although three species of *Tasmanotrechus* have been described from the Mole Creek karst in the Northern Slopes region. Further collections of beetles from these relatively large and hydrogeologically complex karst areas is considered likely to reveal additional species in these genera.

Seventeen (17) described species of Zolini and Trechini are obligate hypogean forms (troglobites) displaying progressive troglomorphic characters and apparently restricted to caves in karst (Map 19). The genera involved are: Zolini: *Idacarabus* (4 spp.) and *Pterocyrtus* (2); Trechini: *Tasmanotrechus* (4) *Tasmanorites* (1) and *Goedetrechus* (6). Three as yet undescribed troglobitic species are also known from the Vanishing Falls karst (? *Idacarabus* sp.; Eberhard et al 1991; 1992) and the Mount Anne karst (*Tasmanotrechus* sp. and *Idacarabus* sp.) (B.P. Moore pers. comm. to S.E. 28th October 1987), with additional specimens required to enable description.

This study has confirmed the typical pattern, also noted by Moore (1972), that each troglobitic species ap-



Map 19 - Tasmanian karst areas (black) and IBRA regions indicating karst areas with troglobitic carabid species. Karst data provided courtesy of Department of Industry & Water, Tasmania.

pears to be confined to a single karst area, however an important new finding is that individual karst areas may support more than a single troglobitic species, for example: Junee-Florentine karst (four species of *Goedetrechus*) and Mole Creek (three species of *Tasmanotrechus*). Moreover, individual caves may harbour two congeneric species which differ in their degree of troglomorphic specialization, suggesting heterochronic colonisation, such as *Tasmanotrechus moorei* sp. nov. and *T. rolani* sp. nov. which occur sympatrically in Kubla Khan Cave at Mole Creek. The radiations of *Goedetrechus* and *Tasmanotrechus* may be partly related to the relatively large, and hydrogeologically complex karst areas in which they occur; both the Junee-Florentine and Mole Creek karsts contain hundreds of caves which are geographically scattered and characterised by complex hydrogeologic relationships. In contrast, the Ida Bay karst is geographically compact and hydrogeologically well-integrated, and supports only a single described species of *Goedetrechus*. Another factor influencing diversity within karsts may be their proximity to Quaternary glaciations, discussed in more detail later below.

Table 2 - Systematic checklist of described Tasmanian Trechinae (excluding Bembidiini) and treated Psydrinae, including the number of collection localities / records (this manuscript and published literature) and IBRA regions where present. Troglobitic species are highlighted in bold. IBRA abbreviations: King (K), Northern Slopes (NS), Northern Midlands (NM), Ben Lomond (BL), Fliners (F), West (W), Southern Ranges (SR), Central Highlands (CH), South East (SE).

Subfamily: Tribe: Subtribe: *Genus*	***Gen.* et *sp.***	**Authority**	***Gen. et sp.* endemic**	**Localities/ Records**	**K**	**NS**	**NM**	**BL**	**F**	**W**	**SR**	**CH**	**SE**
Psydrinae: Amblytelini:													
Amblytelus	*A. montiscampi*	Baehr, 2005	Y	1								1	
	A. niger	Sloane, 1920	Y	1									1
Dystrichothorax	*D. tasmaniensis*	Baehr, 2005	Y	3	1						1		1
Mecyclothoracini:													
Mecyclothorax	*M. ambiguus*	(Erichson, 1842)	N	6				1			1	1	
	M. punctipennis	(Macleay, 1971)	N	1							1		
Tropopterini:													
Pterogmus	*P. rufipes*	Sloane, 1920	Y	2				1					
Theprisa	*T. convexa*	(Sloane, 1920)	Y	9		1				1	1	1	
Trechinae:Trechini: Trechina:													
Goedetrechus	***G. damperi n. sp.***	Eberhard & Giachino	Y	1							1		
	G. florentinus n. sp.	Eberhard & Giachino	Y	1							1		
	G. mendumae	Moore, 1972	Y	2							1		
	G. minutus n. sp.	Eberhard & Giachino	Y	1							1		
	G. parallelus	Moore, 1972	Y	2							1		
	G. rolani n. sp.	Eberhard & Giachino	Y	4							1		
	G. talpinus	Moore, 1972	Y	1				1					
Mimanillus	*M. gracilis*	Moore, 1972	Y	1								1	
Mimotrechus	*M. carteri*	(Sloane, 1920)	Y	3						1		1	
Pogonoschema	*P. pallipes*	Moore, 1972	Y	3								1	
	P. robustum	(Sloane, 1920)	Y	2						1		1	
	P. sloanei	Jeannel, 1927	Y	3						1		1	
	P. solidum	Moore, 1972	Y	1				1					
Sloanella	*S. gordoni n. sp.*	Eberhard & Giachino	Y	1						1			
	S. obscura	Moore, 1983	Y	1						1			
	S. pallida	Moore, 1972	Y	1						1			
	S. simsoni	(Blackburn, 1894)	Y	4				1					
	S. suavis	Moore, 1972	Y	1				1					
Tasmanorites	*T. aberrans*	Moore, 1972	Y	4						1		1	
	T. austrinus	(Sloane, 1920)	Y	4								1	
	T. beatricis n. sp.	Eberhard & Giachino	Y	1								1	
	T. blackburni	(Sloane, 1920)	Y	4								1	
	T. brevinotatus	(Sloane, 1920)	Y	2								1	
	T. cordicollis	Moore, 1972	Y	2							1		
	T. daccordii n. sp.	Eberhard & Giachino	Y	1									
	T. elegans	Moore, 1972	Y	1				1				1	
	T. flavipes	(Lea, 1910)	Y	6									
	T. glaebarum	Moore, 1972	Y	3							1		
	T. grossus	Moore, 1972	Y	5									

Subfamily: Tribe: Subtribe: *Genus*	***Gen.* et *sp.***	**Authority**	***Gen. et sp.* endemic**	**Localities/ Records**	**K**	**NS**	**NM**	**BL**	**F**	**W**	**SR**	**CH**	**SE**
	T. intermedius	Moore, 1972	Y	2							1		
	T. laticollis	Moore, 1983	Y	1									
	T. longinotatus	(Sloane, 1920)	Y	3				1		1			
	T. lynceorum n. sp.	Eberhard & Giachino	Y	1									1
	T. madidus	Moore, 1972	Y	5							1	1	
	T. magnus	Moore, 1972	Y	3				1					
	T. microphthalmus n. sp.	Eberhard & Giachino	Y	1								1	
	T. nitens	(Putzeys, 1874)	Y	1									1
	T. perkini	Donabauer, 2001	Y	1							1		
	T. pullus minor	Moore, 1972	Y	2								1	
	T. pullus pullus	Moore, 1972	Y	1							1		
	T. riparius	Moore, 1972	Y	5						1		1	
	T. tasmaniae	(Blackburn, 1901)	Y	2								1	
Tasmanotrechus	***T. cockerilli***	Moore, 1972	Y	5		1							
	T. rolani n. sp.	Eberhard & Giachino	Y	3		1							
	T. moorei n. sp.	Eberhard & Giachino	Y	1		1							
	T. elongatus	Moore, 1994	Y	1						1			
	T. leai	(Sloane, 1920)	Y	5						1		1	
	T. concolor	Moore, 1972	Y	1							1		
	T. alticola n. sp.	Eberhard & Giachino	Y	1								1	
	T. gordoni n. sp.	Eberhard & Giachino	Y	1						1			
	T. montisfieldi n. sp.	Eberhard & Giachino	Y	1							1		
	T. compactus	Moore, 1983	Y	1						1			
	T. osbornianus n. sp.	Eberhard & Giachino	Y	1							1		
Trechimorphus	*T. diemenensis*	(Bates, 1878)	N	6		1					1	1	1
Trechistus	*T. gordoni n. sp.*	Eberhard & Giachino	Y	2							1		
	T. humicola	Moore, 1972	Y	2							1		1
	T. inconspicuus	Moore, 1972	Y	1				1					
	T. stenoderus	Moore, 1972	Y	1				1					
	T. sylvaticus	Moore, 1972	Y	2								1	
	T. terricola	Moore, 1972	Y	1							1		
Trechodini:													
Cyphotrechodes	*C. gibbipennis*	(Blackburn, 1901)	N	5						1	1	1	
Paratrechodes	*P. macleayi*	(Sloane, 1920)	N	1			1						
Trechobembix	*T. baldiensis baldiensis*	(Blackburn, 1894)	N	3	1							1	
Zolini:													
Idacarabus	***I. cordicollis***	Moore, 1967	Y	2							1		
	I. longicollis	Moore, 1978	Y	2							1		
	I. punctipennis	Moore, 1994	Y	1								1	
	I. troglodytes	Lea, 1910	Y	2							1		
Percodermus	*P. niger*	Sloane 1920	Y	2								1	
Pterocyrtus	***P. cavicola***	Moore, 1994	Y	3						1	1		

Subfamily: Tribe: Subtribe: *Genus*	*Gen.* et *sp.*	Authority	*Gen. et sp.* endemic	Localities/ Records	K	NS	NM	BL	F	W	SR	CH	SE
	P. grayi n. sp.	Eberhard & Giachino	Y	1				1					
	P. globosus	Sloane, 1920	Y	3							1	1	
	P. meridionalis n. sp.	Eberhard & Giachino	Y	1							1		
	P. rubescens	Sloane, 1920	Y	1								1	
	P. striatulus	Sloane, 1920	Y	4				1		1	1	1	1
	P. tasmanicus	(Castelnau, 1867)	Y	2			1	1					
Sloaneana	*S. tasmaniae*	(Sloane, 1915)	N	10	1	1				1	1	1	
	Totals			**196**	**3**	**6**	**2**	**14**	**0**	**18**	**32**	**31**	**7**

The complexities in diversity and distribution have important implications for conservation management, especially in areas such as the Mole Creek karst where multiple congeneric species exhibiting heterochronic and complex phylogegraphic relationships occur within a complex hydrogeologic setting that is further impacted / fragmented by anthropogenic disturbances associated with rural land-use activities.

Eight species have been recorded from both cave and surface habitats, namely: *Tasmanotrechus leai, Tasmanorites flavipes* and *T. grossus, Trechistus sylvaticus* and *T. gordoni* sp. nov., *Pterocyrtus globosus and P. striatulus*, *Theprisa convexa*. While not overtly troglomorphic, these species appear able to opportunistically exploit subterranean habitats as troglophiles or trogloxenes. Other species of *Tasmanotrechus, Tasmanorites* and *Pterocyrtus* are fully troglobitic, indicating a predisposition for exploitation of subterranean habitats by these genera. Several of the species found in ground litter habitats exhibit mild degrees of regressive troglomorphy such as ocular reduction and reduced pigmentation indicative of endogean adaptation, for example *Goedetrechus talpinus* recorded from ground litter / soil on the Blue Tier in NE-Tasmania. The six other described species in the genus *Goedetrechus* are all troglobites restricted to karst areas in the Southern Ranges.

Ecology

In Tasmania, Carabidae are found in moist terrestrial habitats ranging from sea level to the highest mountain peaks (ca. 1400 metres). They are common in ground litter, underneath stones and logs, in rainforest, wet sclerophyll, dry sclerophyll, and mixed-forest types, as well as shrubland and grassland vegetation communities, and caves.

While some species have apparent narrowly delimited distribution and altitude ranges, and ecological tolerances, others have wide distribution ranges and ecological tolerances. An example of the latter is *Dystrichothorax tasmaniensis*, which ranges from sea level to montane-alpine habitats, dry and wet forest types, southwest to northeast Tasmania. Examples of the former include species in the genus *Goedetrechus,* such as *G. talpinus* known only from montane habitats on the Blue Tier, and *G. mendumae* restricted to caves in the Ida Bay karst.

Zoogeography

We identify three broad zoogeographic groups of Trechinae genera in Tasmania, distinguished by their distribution ranges (endemism), degrees of radiation and / or specialization to subterranean life, and presumed age of origin:

Tasmanian endemic genera of presumed ancient origin (pre-Quaternary or pre-Pliocene?) that include distributional relicts, and morphologically highly-modified subterranean species. Genera: *Tasmanotrechus, Goedetrechus, Idacarabus.* All known species in the genus *Idacarabus* are distributional relict forms confined to hypogean habitats, as are all species in the genus *Goedetrechus,* with the exception of *G. talpinus* which is endogean but retricted to the Blue Tier in NE Tasmania. The genus *Tasmanotrechus* has undergone extensive radiation in Tasmania (11 described species) and includes both epigean (7) and hypogean (4) forms.

Tasmanian endemic genera of presumed less-ancient origin (pre-Quaternary?) that includes, normally, forest-dwelling species which have radiated here including *Tasmanorites* (24 described species), *Pterocyrtus* (7), *Sloanella* (5), *Trechistus* (6). This group is characterised by morphologically less-modified subterranean forms in the genera *Tasmanorites* and *Pterocyrtus*. The genus *Tasmanorites* has undergone extraordinary radiation in epigean habitats (23 described species) but with only one hypogean form known. This genus provides a contrast to Group 1 genera where extant radiation diversity is predominantly confined to hypogean forms.

Non-endemic genera also distributed on the Australian mainland, and presumed to be recent immigrants to Tasmania (during Last Glacial?). Genera: *Trechobembix, Cyphotrechodes, Trechimorphus*.

Impact of Quaternary climate change

Historically, in most temperate climate regions of Australia the cave dwelling beetle fauna was thought to

Table 3 - Recorded diversity at selected localities subjected to repeated survey effort. Karst localities and cave records / troglobitic taxa shown in brackets "( )".

IBRA Region	Well-Sampled Localities	No. Records (cave)	No. Genera (troglobites)	No. Species (troglobites)
Ben Lomond	Ben Lomond Mountain	6	3	4
	Mount Barrow	4	3	4
	Blue Tier	7	5	6
Central Highlands	Cradle Mountain	22	8	18
	Lake St Clair	14	8	11
	Waratah	11	8	11
Southern Ranges	Mount Field	13	4	8
	(Junee-Florentine)	20 (15)	8 (1)	11 (4)
	Hartz Mountains	14	7	11

be dominated by troglophiles that were not highly specialized for subterranean existence (Moore 1965), although subsequently Moore (1995) described an exception to this pattern with two highly modified carabids (Zuphiini) from the the Nullarbor Plain. In Australia's tropical climate regions, extremely diverse and specialized subterranean faunas have been discovered in lava tube caves in North Queensland (Howarth and Stone 1990), and more recently in meso-cavernous habitats developed within weathered iron-ore bearing rocks in the Pilbara region of Western Australia (Eberhard et al 2008). The Pilbara subterranean fauna includes Zuphini and Anilini carabids. In the Pilbara (including Cape Range and Barrow Island) the terrestrial troglobitic fauna predominantly comprises distributional relict forms presumed to be derived from epigean lineages which inhabited wet forest environments present across the region during the Tertiary (Humphreys 2000). As inferred for the rich aquatic subterranean fauna of Western Australia, increasing aridity during the Quaternary is considered the principal environmental factor driving colonization and isolation in subterranean environments here.

In the northern hemisphere, troglobite distribution patterns concordant with ice limits were explained by the 'Pleistocene Effect Model' or 'Climatic Relict Hypothesis' (CRH) (eg. Holsinger 2000). This model assumes that climatic and associated environmental changes (eg. altitudinal or latitudinal retreat or expansion of forest versus alpine vegetation) causes local extirpation of surface populations and the genetic isolation of troglophile populations in subterranean habitats thus facilitating troglogenesis. Underground isolation of troglophilic species normally associated with alpine environments could occur during altitudinal retreat of the alpine zone (with concomitant expansion of the forest zone) during interglacial periods. Conversely, isolation of troglophilic species normally associated with moist forest habitats would be more likely during glacial periods when the tree-line retreats and the alpine zone expands. Subterranean Coleoptera have been repeatedly cited as classic examples supporting the CRH, based on numerous studies undertaken in Europe (see for examples Juberthie and Decu 1994 – 2001; Gibert and Deharveng 2002) and North America (Barr 1960; Peck 1984).

In remarking on Tasmania's diverse assemblage of specialized subterranean carabids, Moore (1965) postulated a linkage with Quaternary climate changes and glaciations, which he presumed was analogous to the situation in the northern hemisphere where the distribution limits of troglobitic beetle (and other invertebrate troglobite groups) dovetailed with limits of maximal Pleistocene glaciations. In North Temperate regions glaciated areas have a depauperate terrestrial cave fauna, and cave areas near glacial boundaries have an exceptionally diverse fauna (Culver and Pipan 2009). This mid-latitude biodiversity ridge (Culver et al 2006) is evident across continental Europe, Asia and North America, however it remains to be seen if this pattern is repeated in the southern hemisphere. Southern hemisphere mid-latitude land masses encompass South Africa, Australia (Tasmania), New Zealand and South America. While climate change mechanisms and processes may be essentially the same, and globally broadly synchronised, South Temperate regions are dominated by oceanic versus continental climatic influences. The main difference expressed during Quaternary glaciations was that the large northern hemisphere continental land masses experienced massive southward progressing ice sheets with well-demarcated ice-limit boundaries. While ice sheets developed in the comparatively smaller southern hemisphere land-masses of South America, New Zealand and Tasmania, oceanic proximity moderated temperatures and ice sheet development, while topographic heterogeneity promoted cirque and valley-style glaciation. In Tasmania this resulted in a complex mosaic of glacial ice limits, still incompletely mapped, thus complicating interpretation of present-day biodiversity distribution patterns. Terrestrial troglobitic faunas are known from each of the South Temperate land masses, albeit poorly described and mapped in comparison with Europe and North America. With addition of the new species described herein, we take this opportunity for a reappraisal of the 'Pleistocene effect' (CRH) in attempting to understand the present day distribution of Tasmanian cave beetles.

While Tasmania was known to be extensively glaciated in the Pleistocene, the rugged mountainous topography with strong altitudinal and longitudinal gradients in climate and vegetation have resulted in a complex glacial history with at least four pre-last Interglacial glaciations (Augustinus & Macphail 1997). The Last Glaciation was smaller than middle and early Pleistocene glaciations (=Pre-Last Glaciations), and during lowered sea levels of glacial periods Tasmania was a peninsular connected to the Australian mainland (Map 20).

The chronologies and finer scale complexities of ice extent and associated vegetation changes, and the geomorphic impacts of glaciation on karst, have been better elucidated in the last few years (eg. Augustinus and Macphail 1997; Colhoun, et al 1996, Eberhard, R. 1997; Kiernan et al 2001; Kirkpatrick & Fowler 1998). The Last Glaciation commenced after 26-25 ka BP, peaked at 19 ka BP and all known ice had decayed by 10 ka BP (Colhoun et al 1996). The snowline was lowered by about 1000 m, and mean temperature was depressed by about 6-6.5^0 C from present. Icecaps and associated outlet valley glaciers developed on the Central Plateau and West Coast Range, and isolated cirque glaciers formed leeward of mountain ranges in the east (Colhoun et al 1996) (Map 20).

Pre-Last glaciations were more extensive than the Last Glaciation, and involved a much more extensive icecap covering the Central Plateau and major valley outflow glaciers that extended nearly to the present northern coastline (Map 20). Mountain ranges in the south were also extensively ice covered, as well as Ben Lomond Plateau in the northeast. Differentiating the ice limits and chronologies of Pre-Last glaciations remains less well resolved than for the Last Glaciation, however the most extensive glacial event, the Bulgobac Glaciation, is early Pleistocene to latest Pliocene in age (Augustinus and Macphail 1997). Other glacial event(s) occurred in the middle Pleistocene.

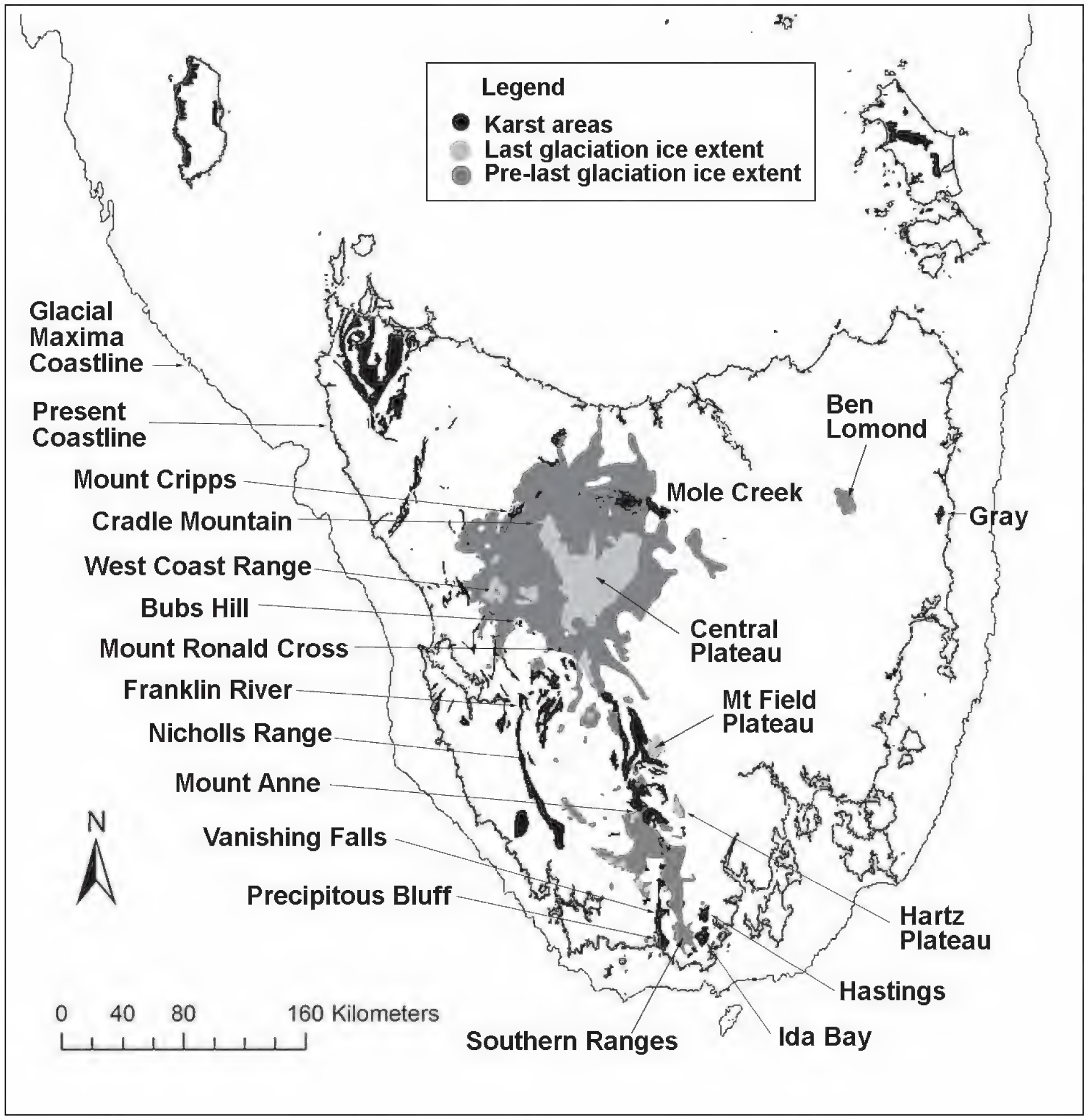
Glacial/interglacial cycles involved profound changes in climate and vegetation. Interglacial climates were warmer with more effective precipitation and forest cover increased as the treeline advanced upslope. Glacial climates were colder and drier, and forest cover decreased as the treeline retreated and alpine vegetation expanded. Kirkpatrick & Fowler (1998) modelled vegetation changes at the height of the Last Glacial, which indicated that rainforest/wet eucalypt forest covered 7.2% compared with 71.3% at present. Conversely, alpine and grassland/grassy woodland covered 45.5 % and 32.5 % compared with 0.1 and 8.7% at present. Kirkpatrick & Fowler's (1998) model of the vegetation changes suggested that at the height of the Last Glacial, Tasmania was largely covered by alpine vegetation, grassland and grassy woodland, while rainforest was restricted to valleys near the present coast, some deep continental inland western valleys, and to tiny refugia in the east (Map 21). During earlier more extreme glaciations, the extent of alpine vegetation would have been greater, and the areas of rainforest refugia presumably even more contracted.

Probably upwards of one dozen Tasmanian karsts were overridden by glaciers during the Pleistocene, while others lay marginal to ice (Kiernan 1982). Some karsts, including Mole Creek, Mount Cripps and Mount Ronald Cross, were over-ridden by ice during the Pre-Last Glaciations but assumed marginal peri-glacial positions during the Last Glaciation (Map 20). It is therefore predicted that the present-day cave beetle fauna colonised these karsts after the Pre-Last Glaciation, possibly during the Last Glaciation when forest cover retreated from the karst and isolated the putative troglophilic progenitors in caves. The troglobitic trechines in each of these three karst areas belong to moderately troglomorphic forms (*Tasmanotrechus, Tasmanorites, Idacarabus punctipennis*) consistent with a more recent derivation.

The centrally located karsts (Junee-Florentine and Bubs Hill) may not have been completely overridden by ice during any of the Pleistocene glaciations, however they were certainly profoundly affected by peri-glacial conditions and processes as they lay immediately marginal to glaciated massifs and would have been subjected to major changes in thermal, hydrological, sediment and vegetation regimes during cold climate episodes (Map 20). In the Junee-Florentine (and other glaci-proximal karsts) for example, the caves received inflows of proglacial meltwater laden with sediment which in-filled the caves, which were then partially re-excavated after return to milder conditions with lower clastic load (Goede 1973; Kiernan 1982). Speleothem dates indicate multiple episodes of sediment aggradation correlating with Last Glaciation and Pre-Last Glaciation, including > 350 ka (Eberhard 1997; Kiernan et al 2001).

How peri-glacial conditions and processes in the glaci-proximal karsts affected the subterranean habitat for beetles remains speculative, however it may help in explaining the absence of more highly troglomorphic, presumably older, cave colonists in the glaci-proximal karsts such as Mole Creek, Mount Cripps, Bubs Hill, Junee-Florentine, and Mount Anne (Maps 19 & 20). If older troglobites had existed in these karsts, it seems more probable they were extinguished during the more extreme Pre-Last Glaciations. Extinction of pre-existing forest and cave faunas during glacial periods would have provided unoccupied niches for new colonists during subsequent interglacials when the forests and forest fauna, including taxa with troglophilic tendencies, recolonised deglaciated terrains including karsts.

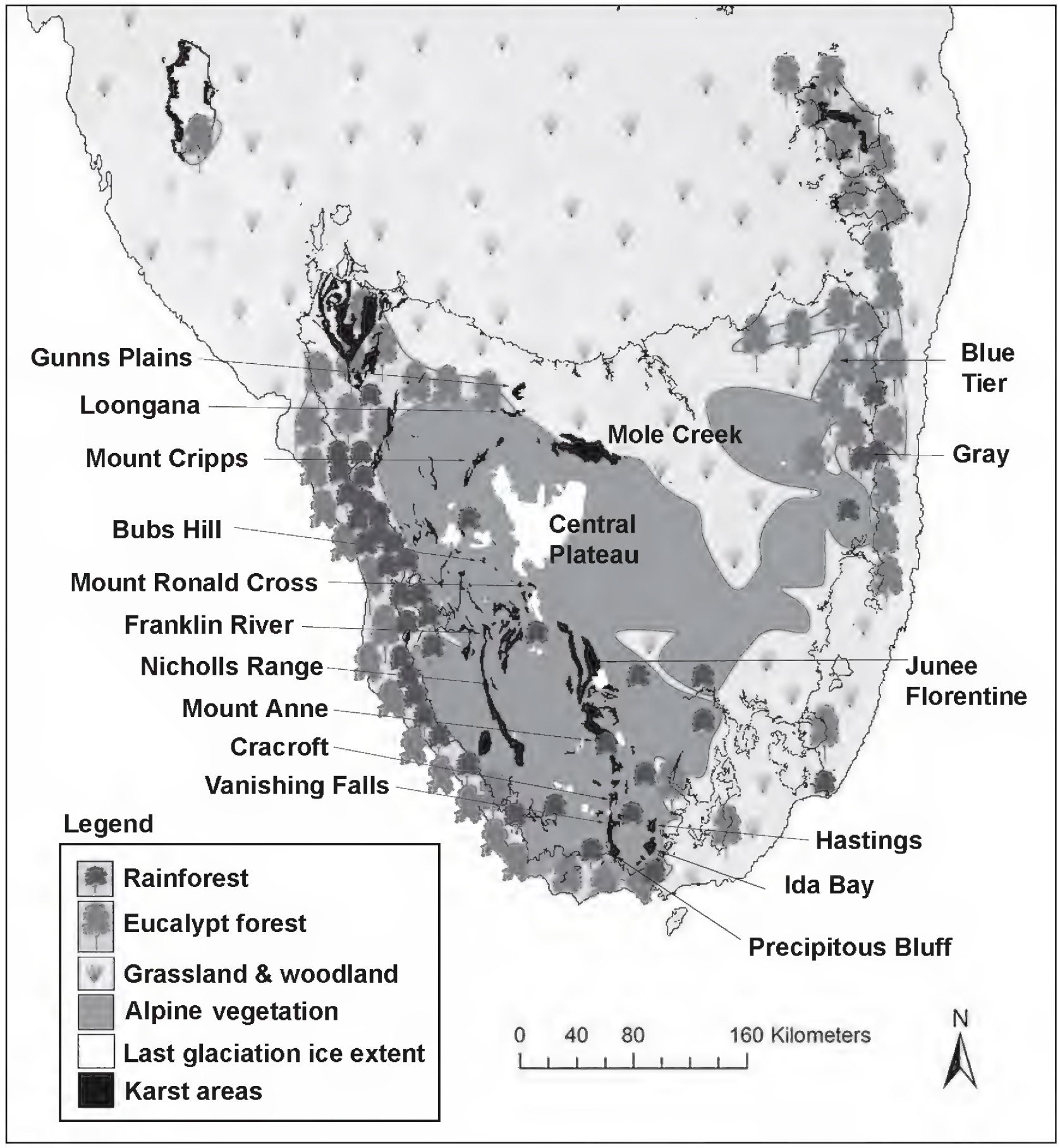
Rainforest and wet eucalypt forest persisted in far-southern near-coastal areas during the height of the Last Glacial (Map 21), including in the vicinity of Ida Bay and Precipitous Bluff karsts where the highly troglomorphic *Goedetrechus mendumae* group is found. These karsts lie adjacent to the Southern Ranges which remained ice-free during the Last Glaciation (Map 20). The Southern Ranges were glaciated during Pre-Last Glaciations when



Map 20 - Tasmania showing present coastline and glacial maxima coastline, karst areas and ice extent in Last glaciation and Pre-Last glaciations. Karst and glacial data provided courtesy of Department of Industry & Water, Tasmania.

proglacial streams deposited extensive gravels in base level stream passages at Ida Bay, although higher level sections of this karst remained unaffected by sedimentation. Glacial and periglacial effects on Precipitous Bluff were comparatively mild compared to all other Tasmanian karsts, as evidenced by the paucity of sediment infilling in the caves there, and comparatively little evidence of cold climate freeze-thaw weathering processes such as dolerite talus slopes which characterise other dolerite-capped mountains in Tasmania.

For epigean species whose present-day distribution range encompasses localities situated within the ice limits of the Last Glaciation, then these populations must have colonised these localities post- Last Glaciation. Perhaps coincidentally there is a notable paucity of published collection records from within the Last Glaciation ice extent, although this may well be an artefact of limited sampling, especially inside the area of the Central Plateau ice-cap (Maps 19, 20). During glacial periods the ice-covered and peri-glacial Central Highlands and Southern Ranges would have formed an extensive barrier separating forested lowland habitats on the west and east sides of the island, as well as accentuating the disconnection between northern and southern lowland habitats



Map 21 - Tasmania showing modelled distribution of vegetation types at the height of Last Glacial (based on Kirkpatrick & Fowler 1998) and karst areas. Modified from map prepared by Dr Greg Jordan (University of Tasmania). Karst and ice data provided courtesy of the Department of Industry and Water, Tasmania.

(Maps 20, 21). This 'Pleistocene Effect' has been invoked to explain the east-west parapatric distribution patterns observed in epigean genera of grasshoppers, frogs, freshwater decapods, and terrestrial amphipods, although some other faunal boundaries in Tasmania are less obviously congruent with (paleo-) climatic, topographic, geologic, or vegetation gradients (Mesibov 1994).

For populations whose present-day distribution lies outside the Last Glaciation ice limits, but within Pre-Last Glaciation limits, establishment of these populations must post-date the Pre-Last Glaciation(s). An apparent pattern of biodiversity hotspots, in both epigean and hypogean carabid diversity, is suggested for mountainous localities situated just outside the Last Glaciation ice limits but where peri-glacial conditions still occurred. Examples of peri-glacial localities with high epigean species richness recorded are Cradle Mountain, Lake St Clair, Mount Field and Hartz Plateaux, and Ben Lomond (Table 1, Map 20). Similarly, high diversity in hypogean species is suggested for karsts located marginal to glaciated massifs, as demonstrated for Mole Creek and Mount Field (Junee-Florentine). Other glaci-proximal karsts known to contain troglobitic trechines include Mount Cripps, Bubs Hill, Mount Ronald Cross, Mount Anne, Vanishing Falls, Hastings and Ida Bay (Map 19). Exceptions to this pattern are evident, with troglobitic beetles apparently absent in other Tasmanian karsts with well-developed cave systems (eg. Loongana, Gunns Plains,

Cracroft) (Map 21), although it is noted that troglobitic trechines (cf. zolines) are rarely encountered during biological surveys, with most described species known from a single, or just a few, specimens. Because of their inherent rarity, additional survey effort in these and other glaci-proximal karsts is warranted.

When local hotspots are interpolated based on broad altitudinal topography, a gross contour of biodiversity richness may be inferred which roughly encircles the Central Plateau, and similarly, other glaciated massifs in the Southern Ranges IBRA including the Mt Field Plateau and the Hartz Plateau (Maps 19, 20, 21). Replicated sampling in strategically selected, geographically intermediate localities (including glaci-proximal and glaci-distal karsts) is required to test if the inferred patterns are real, or an artefact of patchy survey effort and historical sampling biases. In the meantime, the observed patterns are broadly consistent with North Temperate regions in respect of enhanced diversity near glacial boundaries (Culver and Pipan 2009). Accordingly, we propose that present-day troglobitic Trechinae in Tasmania are derived from troglophilic progenitors that colonised subterranean habitats from adjacent forest ground litter habitats during Pleistocene interglacial periods, while retreat of forests during glacial periods isolated subterranean populations from surface populations facilitating troglogenesis.

Subterranean colonisation by forest-dwelling (sylvicolous) versus alpine-dwelling (alticolous) progenitors is suggested by the present-day ecology of epigean congeners of subterranean forms, which are predominantly sylvicoles (*Tasmanotrechus, Tasmanorites, Pterocyrtus, Goedetrechus*). While no epigean forms of *Idacarabus* are known, the present-day patterns in *Goedetrechus* spp. support the case for forest-dwelling progenitors in this lineage. All known species in this genus are hypogean, except for *G. talpinus*, which is described by Moore (1972) as endogean. This species has very reduced eyes and was collected from soil and humus at 600 m altitude on Blue Tier in northeast Tasmania, where the present-day vegetation is rainforest. Parts of northeast Tasmania seem to have maintained climates suitable for rainforest and wet eucalypt forest from the height of the Last Glacial to the present, and the Blue Tier refugium is almost certainly the source for re-colonization of the north-eastern highlands that now support large tracts of rainforest (Kirkpatrick and Fowler 1998). It seems probable therefore, that the now extinct surface ancestors of troglobitic *Goedetrechus* spp. in the southern karsts colonised caves from adjacent rainforest habitats during interglacial periods, with isolation of cave populations occurring when forests retreated during glacial periods.

In both *Tasmanotrechus* and *Goedetrechus*, typical troglomorphisms include progressive elongation of legs and antennae, and progressive reduction in body pigmentation and eye size. Other modifications are contrastingly different between genera, and are related to the shape of the pronotum, changes in body size, and degree of eye regression. Cave-dwelling *Tasmanotrechus* and *Goedetrechus* exhibit differing degrees of troglomorphic specialization, with cave-dwelling *Tasmanotrechus* spp. overall less-troglomorphic than cave dwelling *Goedetrechus* spp. The only other trechine genus exhibiting troglobitic tendencies is the speciose genus *Tasmanorites,* with a single known subterranean species, *T. microphthalmus* from the Mount Cripps karst. This species has well-developed troglomorphy albeit less specialized than *Goedetrechus* spp.

Excepting the singleton species *T. microphthalmus* the most highly troglomorphic Trechinae (*Goedetrechus* and *Idacarabus*) are found in southern karsts, while central and northern karsts appear to be characterised by less troglomorphic genera and species (*Tasmanotrechus* and *Pterocyrtus*). Assuming that the degree of troglomorphy equates to time of isolation underground, it is hypothesised that the highly troglomorphic species group (*Goedetrechus mendumae* group) found in southern karsts (Ida Bay, Precipitous Bluff) represent an earlier phase of cave colonisation, while the less troglomorphic species groups (*Goedetrechus parallelus* and *Tasmanotrechus cockerilli* groups) found in the central (Junee-Florentine, Bubs Hill) and northern karsts (Mole Creek) represent more recent colonisation(s).

Idacarbus spp. are distributional relicts represented entirely by subterranean forms, all from Southern Ranges karsts, with a single species in the centrally located Mount Ronald Cross karst. No representatives of this genus have been recorded from northern karst areas. In the southern karsts, Moore (1978) noted that the three species of *Idacarbus* formed a graded series in terms of decreasing cave adaptation from northeast to southwest, and he suggested that this reflected time of isolation underground, and therefore also, timing of the onset of Pleistocene glaciation. Considering the relatively small geographic distance separating these three karsts (< 50 km) the timing of glacial onset is unlikely to have differed significantly, although time of isolation underground may have varied depending on which, of multiple Pleistocene glaciation(s), were the vicariant events. This question could be investigated using DNA 'molecular clock' methods.

The broad North-South differences in taxonomic representation, and degree of troglomorphy, do not obviously conform to the glacial history and/or palaeo-vegetation maps, hence we do not discount additional or alternative mechanisms to explain the observed patterns in cave dwelling beetles. We note that troglobitic trechines are not restricted to mid and high-altitude karsts which were more strongly influenced by glacial and peri-glacial conditions in the past. Troglobites are also present in low -altitude karsts geographically distant from glaciated mountains, notably the Gray karst in northeast Tasmania, and the Franklin River and Nicholls Range karsts in the West (Maps 19 & 20). In these karsts troglobitic trechines are represented by zoline species of *Pterocyrtus,* a genus which also holds several extant epigean species which are a typical element of forest litter. The subterranean forms of *Pterocyrtus* are only weakly troglomorphic sug-

gesting they are more recent colonisers of subterranean habitats. Kirkpatrick and Fowler's (1998) model suggests that during the Last Glaciation the Franklin River and Nicholls Range karsts were covered by alpine vegetation, whereas the Gray karst maintained climates suitable for rainforest and wet eucalypt forest (Map 21).

Overall, a broad-scale phylogeographic pattern in Tasmanian cave beetles is suggested which involves more highly troglomorphic forms in southern karsts, and less-troglomorphic forms in western, central and northern karsts. Interestingly, this pattern of troglomorphic adaptation is also suggested in several other invertebrate groups with cave dwelling representatives, including: dalodesmid millipedes (Mesibov 2005); hydrobiid molluscs (Ponder 1992; Ponder et al 2005); triaenonychid harvestmen (Hunt 1990; Hunt & Hickman 1993); synotaxid (Forster et al 1990), amphinectid (Davies 2003) and micropholcommatid (Rix & Harvey 2010) spiders.

This study has rekindled our interest in four fundamental questions: (1) Is the degree of troglomorphy and apparent heterochronous colonisation exhibited by sympatric subterranean congeners concordant with the palaeoclimatic history?; (2) What is the evidence of Pleistocene glacial / inter-glacial influences on distribution patterns of other Tasmanian invertebrate groups, including epigean and hypogean species?; (3) To what extent do the observed patterns support or reject the "Climatic Relict Hypothesis" (see Holsinger 2000) or the "Adaptive Shift Hypothesis" (see Howarth 1987) in driving the evolution of hypogean and epigean species?; (4) To what extent does the cave fauna described to date represent the tip of the iceberg in relation to non-karstic MSS / SSH subterranean biodiversity?

Future research should focus on systematic field surveys of both karst and MSS/SSH habitats to elucidate the phylogeographic patterns in selected taxa and test how the observed distributions fit with the processes and chronology of Pleistocene glacial / inter-glacial cycles. Alternative, or additional, environmental mechanisms driving troglogenesis need to be considered. Investigations should not be limited to subterranean taxa and their related epigean relatives, they should also embrace taxa without subterranean connections. Undoubtedly future serious collecting efforts will reveal many additional new subteranean species, including from previously well-collected caves and karst areas, not to mention the many caves, karsts and non-karstic MSS habitats that remain to be surveyed. We conclude that a crucial element, biogeographically and palaeoclimatically, of Australia's rich hypogean and endogean biodiversity, hitherto only recently recognised as globally significant (Humphreys 2008; Guzick et al 2010), lies undiscovered beneath Tasmania's dark forests.

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